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Oceanography

Meteorology

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Vol. 64, No. 44, Pages 617-624

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Particles and Fields-Magnetosphere

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November 1, 1989

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Yews

New Observations From ISEE-3

On June 30, 1983, the International Sun-Earth Explorer-3 spacecraft (ISEE-3) was at an spage of 236 earth railii 1RE) exploring paride and field phenomena in the carth's distant magnetic tail region. Most of what we know about the earth's magnetinall is based on spacetraft observations made inside of the hoar orbit distance (approximately fit) R_E), and a few brief passes of several interplantsay spacecraft through the more distant tail. ISEE 3 is greatly extending the exploration of the gentail by spending a large part of 1983 in the earth's magnetic tail hetween (it)

There will be a special session in the 1983 AGU Fall Meeting which will locus on the new geolail results. In December, ISEE-3 will make a final lunar swing-by, coming within 100 km of the surface of the mount. This maneuver will propel ISEE-3 out into the solar suen, where it will pass through the tail of comes Giacobini-Zinner in early September 1985. Later, in March-April 1986, ISEE-3 will monitor the solar wind conditions near Haller's comer while other spacecraft from around the world get a close-up view. ISEE-3 celebrated the fifth anniversary of its launch

on August 12. Normally, for a spacecraft in orbit about the earth, apogee precesses from the sunward side of the earth to the antisunward side and backduring the course of one year. ISEE-3. however, has used two hunar swing-hys to ollserthis natural precession and thus has ingreated the time available for studying the georal. ISEE-3 was at an apogee of $221~R_F$ in the georall on February 8. Then, on March 30. it was maneuvered inno its lirst encounter with the moon (SI in the cover figure) which paratimo an orbit with apogee at 81 RE A2). Precession of this new orbit, plus aretion of the moon in its own orbit, allowed the

second lunar swing-hy (S2) on April 23, wouling ISEE-3 back out into the clistant gentail. This technique, imangurated by this mission. was developed by Robert Farquiar of the Goddard Space Flight Center.

Analysis of the geotail data from ISEE-3 is sill in its early stages, but interesting features hae already been observed. Data from the magnetic field experiment (Jet Propulsion Laboratory (JPL)/University of California, os Angeles/Brigham Young University) and relectron plasma experiment (Los Alamos Lional Laboratory/Sandia Laboratories) reealthat all of the major magnetotail field and plasma regimes identified previously by ear-earth measurements (e.g., low beta magstic lobes separated by a plasma sheet in which a neutral sheet is embedded) remain ecognizable entities in the distant tail. Howact, transitions from one regime to another as observed more frequently than near the such. The JPL and Lus Alamos groups curleady favor different explanations for this; the JPL group suggests that the frequent transitons are due predominantly to back and forth meeting of the deep tail, while the lor Alamos group suggests that the deep tail may be exhibiting a transition in a lilamenta-Barnetire. Data from all three ISEE spacetalt will be studied thuring the next year to

belo define the burge-scale structure of the genal and to resulve this question.

The JPL magnetometer group finds that their observations suggest the following features of the fleep tail: (1) two distinct lobes with steady, quiet, solar and autisolar directed fields, separated by (2) a neutral sheet embedded in (3) the plasma sheet and its (4) boundary layers and (5) the magnetopause

by P.N. Mayaud

From the Foreword:

Geophysical Monograph 22

Explains it all.

... ihis book will surely ba recognized in

tha years to come as a classic. Scientists

phanomana, solar activity, etc.l will find

that this monograph contains all that

they used to know about any of the

geomagnatic indices that may interest

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Alexandar J. Desslar

in diversa fields of research lauroral

Derivation, Meaning, and Use

of Geomagnetic Indices (1980)

Inquillary layer. Tail llaring ceases beyond a distance of 100 to 120 R_E , where the tail flux appears to become constant. Multiple magnetopanise boundary crossings are consistent with tailward moving waves of amplitude less than 1 R_E and wavelengths of ~60–180 R_E . probably caused by typical solar-wind flow direction and pressure variations and/or Kel-vin-Helmholtz instability. In addition, multiple neutral sheet crossings are often observed. The periods of the oscillations range from 5 to 25 minutes and their wavelengths

are thus no the order of 20 to 80 RE. In cuntrast, the Los Alamos group helieves that flapping of the tail is probably not the origin of all nl the observed variability. Rather, their initial interpretation is that the distant tail may be by nature highly structured, perhaps reminiscent of the visible structure of many innic counct tails. This structure enuld be interpreted in terms of a hlamentary tail, a "magnetuspheric wake," tail hreakup and reconnection phenomena, or possibly other processes. Fundamental new features have been de-

tected in the magnetic field data in and near the plasma sheet and its boundary layers. Siguilicam snuthward lields with negative By components are detected in the plasma sheet at distances heyond 100 RE to apogee, 240 RE. These permanent features of the tail are not corrently understood and theoretical models are being explored. Compressive, solitary MHD waves, pmbably propagating in the fast mode, have been detected in the tail lobes. Passage of the waves leaves the held tihed in towards the neutral sheet and is followed by a slight depression of the field magnitude lasting about an hour. Such effects may be rarclartion waves which are associated with 8ux removal from the tail. Large amplitude (5 nanotesla), coherent ion-cyclotron waves have been detected near the plasma sheet bound-

The emissions are left hand circularly polarized in the sparecraft frame and propagate along the magnetic field direction. The possibility that these emissions are generated by streaming anisotropic proposs is currently be-ing explored. The magnetic held signature of hubbles or plasmoids is also frequently observed within the plasma sheet, usually near the plasma sheet boundary levers. These buldbles are believed to be the result of magnetic held merging within the magnetotail and may propagate either tailward or carthward. Earthward flow of electrons within the

plasura sheer has been observed occasionally by the Los Alamos group, suggesting the temporary presence of a neutral line, i.e., magnetic reconnection region, beyond 220 RE. Most of the time, however, these electrons are observed to be flowing down the tail, away from the earth with mean velocity of about 500 km s.1. This is considerably higher than is usually observed within the quiet-time near-earth plasma sheet. The plasma velocity has also been interred by the Max Planck Institute/University of Maryland group, based on measurements of suprathermal ions. Assuming that these ions are convected with the plasma sheet thermal plasma, they find that the velocity increases with increasing distance frum the earth from a value of ~200 km s-1 at 70 RE tu >400 km s1 at ~200 RE. The He++/H+ ratio at equal energy/charge has been observed by this same group to be about 3% to 6% in the plasma sheet. This is lower by a factor of 2 to 3 than that typically observed in the boundary layer and plasma sheet boundaries. The energetic particle auisotropy spectrometer (Imperial College/ES-TeC/Utrecht) measures the flow of suprathermsl ions with charge ≥ 1 in the energy range 35-1600 keV. The Imperial College group finds that the highest fluxes of ener-

Dr. Mayaud presonts a historical review

of indicas officially recognized by tha

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Gaoglagnatiam and Aeronomy.

getic ions are found in the plasma shret (~10-100/[keV s cni" sr) at 35-56 keV). These ions stream away from the earth except at times of earthward plasma thow when earthward ion streaming is observed.

lon intensities are found to typically be an order of magnitude lower in the houndary layer and lobe regions where "pancake-like" pitch-angle distributions occur, the ions having pitch angles close to 90° with respect to the magnetic field direction. This distribution may be prochiced if field lines in these regions are open to the interplanetary magnetic field, allowing ions with small pitch angles to escape rapidly from the tail. In the magnetosheath and occasionally in the boundary layer, borst-like ion enhancements with durations of around 10 minutes and exhibiting strong streaming from the earth are the served. These enhancements do not appear to be associated with structure in the tail plas ma, suggesting that they are not the result of a plasma filament including high flaxes of energetic inns llapping past the spacecraft. The energy spectra of the suprathermal iuns do not vary significantly between plasma re-gions in the tail.

The Los Alamos group reports observing rotations of the electron bulk flow, reminiscent of plasma vortices, in the distant tail with rotation periods (5-10 minutes) and directions of rutation similar to those found in near-earth measurements. Another discovery by the Los Alamos group is that the electron velocity distributions in the distant tail are commonly bi-directional in all regions except the lubes. A similar hi-ilirectionality is sometimes observed in the near-earth tail, most commonly at the outer edge of the plasma sheet, but is relatively infrequent. Although electron bi-directionality is commonly interpreted as evidence for closed held lines, it is not currently clear that this is the only interpretation for the deep tail, by particular, bevond 180 Rg the plasma wave experiment (TRW/University of Towa/JPL) measured a dramatic increase in plasma un bulence as reflected in electric field measurements in the lew hymbred Hy to 2 kHz frequency range.

Comparison with the electron plasma data shows that this unfodence occurs in the plas ma-theer boundary layer and is rather well correlated with bi-directional electron anisotropies. The associated waves are very likely Doppler-shifted ion acutistic waves, although they could also be harmonics of the electron cyclotron frequency. The plasma wave experimenters also report time structure in the electric field continuous a higher frequencies 15-15 kHz), which is reminiscent of sular type III bursts. It is possible that, as in the case of type III bursts, beams of electrons are stimulating this continuum-type emission. By con-trast, the continuum emission observed by the TRW group at Jupiter is fairly constant in

This news item was contributed by Tycho you Rosenvinge, who is with the NASA Goddard Space Flight Center, Greenbelt, MD 20771.

Wet "Water Year"

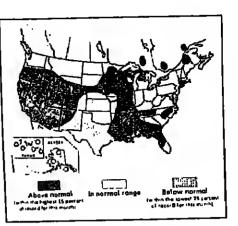
The nation's streams for the 1983 water year (October 1, 1982, in September 30, 1983) were much wetter than average, ronsidering the dry conditions that prevailed over much of the East and the Midwest at the end of the water year, according to the U.S. Geological Survey (USGS).

USGS hydrologists said that for 174 key index gaging stations across the country, 48% had flows that were well above average [within the highest 25% of recordl for the water year and unly 6% (11 stations) reported well below average flows (within the lowest 25% of

Above-average flows for the water year stretched from Oregon and California into Rucky Mountain region and as far east as parts of Nebraska. The wet conditions also blanketed much of the area thrained by the Mississippi River, from Minnesona to Louisiana. Streamflow for much of the Gulf Cuast reginu and east inth Georgin and Florida was also above average for the water year, the plie well below average flows throughout the Southeast in recent months (see map, courtesy of USGS).

The water-year concept is designed to roughly follow the growing seasun and in begin and end during a period of generally low streamflow. Despite the dramatic downum for some

streams in the East and the Milwest in recent months, the overall picture for the nation was above average for the water year," sald Car-roll Saboe, USGS hydrologist and chief of the hydrologic information unit, Reston, Va. "For some streams, the unusually wet winter and the excessive runoff from the spring rains and anowmelt boosted flows and groundwater levels to such high levels that there was sufficient carryover to supplement streamflow into the drier months that followed. Had there not been that extra cushion of runoff, we could have seen a much more widespread drought than what we actually experienced."



As a further indication of the generally healthy state of the nation's water resources for the 1983 water year, the rumbined flow of the three largest rivers in the coterminous United States—the Mississippi, St. Lawrence, and Columbia—was 3737 billion liters per day 1822 hillion gallous a day), 26% above average for the water year.

Water Resources Research Editor

The leading journal in the water sciences is seeking cambidates and nominations to vurceed Stephen J. Burges, whose term as editor ends December 1984.

To respond to the increasing mamber of high-quality submissions, Water Revocate Research (WRR) will be published monthly be-ginning January 1984. The successful caudidate will handle original comritutions on the physical, themical, and biological asperts of water rescarrh.

AGU President James A. Van Allen hav appointed a committee to recommend caudi-dates for the 1985–1988 term. Resources of those interested in serving in this prestigious post, or letters of recommendation from those who wish to suggest cambilates for it. should be sent by February 15, 1984, to WRR Editor Search Comminee, American Geophysical Union, 2000 Florida Ave., N.W., Washington, DC 200001.

Carbon Dioxide and Climate

The earth's climate is getting warmer he-cause of a buildup of carbon dioxide in the aunosphere that will continue well into the next century, according to a report released October 20 by the National Research Council INRC), the research arm of the National Academy of Sciences. As the result of a 2year study commissioned by Congress, the NRC's Carbon Dioxide Assessment Committee predicts a global temperature rise of as moch as 4.5°C by the year 2100, enough to shift weather patterns, raise sea levels, and eliminate agriculture in some parts of the world. What's more, the trend seems inevitable-even drastic changes in our energy use would not prevent the warmup, according to

the committee's findings.

CO₂, the major contributur to a thermal "greenhouse effect" that traps re-radiated heat in the atmosphere, has risen from a concentration of 315 parts per million lppm) to 340 ppm in one generation, largely as a result of the use of fossil fuels. Sometime in the third quarter of the next century, the report predicts, the concentration will probably be double the current level. The result will be a global warming of surface air of between 1.5° and 4.5°C, with temperature rises relatively

greater at the poles.

The committee predicts "with considerable confidence" this overall increase in the me global temperature, then gues no in extra polate more specific effects. Sea level, for example, will rise sharply compared to the 15 cm it has risen during the past century. "If a global warming of about 3 or 4°C were in occur over the next hundred years, it is likely that there would be a global sca-level rise of about 70 cm," the report states, because of melting gladal ice and the expansion of upper ocean waters as they heat up. If the west Antaretic ice sheet should begin to break up, the rise lu sea level could be even grenter.

The committee also foresees that summer soil moisture will decrease in the middle and high latitudes of the northern hemisphere and that a warming of even 2°C will severely reduce the quantity and quality of water resources in the western United States by affecting rainfall and river discharge. Despite the warmer, drier climate, the committee believes that these negative impacts on agricul-ture will be offset, at least "over the next couple of decades," because plants will be more efficient in using water and producing food in a COs-rich environment. The more severe

News (cont. on p. 931)

Geophysical and Geochemical Consequences of Nuclear Explosions

An all-Union session on the geophysical and geochemical consequences of nuclear explosions was contmissioned by the AGU Public Affairs Committee and will be given at San Francisco Wednesday morning, December 7, 1983. The session is deliberately restricted to aspects within die domain of the American Geophysical Union. and the social, political, and ethical issues will not be treated explicitly. It is inevitable that such issues will be present in the minds of the speakers and audience, but they cannot be evaluated by rigorous scientific methods. The aim of the session is to examine the possible range of geophysical and geocliemical consequences of varions scenarios involving nuclear explosions. Such scenarios extend from a single nuclear explosion to a major nuclear exchange involving thousands of weapons. A Wednesday afternoon session at the Fall Meeting will examine atmospheric conse-

Moral Obligations

We geophysicists and geochemists have a nuoral obligation to scrutinize all pertinent data and speculations as thoroughly ns possible, and present the conclusions without lans and prejudice. I must confess to a fear and hatred of the subject; I om forced to screw up my courage to read the literature. As justification for our involvement in this session, consider this quotation from "The Effects of Nuclear War" [Office of Technology Assessment, 1980]:

"At the request of the Senate Committee on Foreign Relations, the Office of Technology Assessment has undertaken in describe the effects of a nuclear war on the civilian populations, economies, and societies of the United States and the Soviet Union.

"Nuclear war is not a comfortable subject. Throughout all the variations, possibilities, and uncertainties that this study describes, one thente is constanta nuclear war would be a catastrophe. A ntilitatily plausible nuclear attack, even 'limited,' could be expected to kill people and to inflict economic damage on a scale unprecedented in American expenence: a large-scale nuclear exchange would he a calamity unprecedented in human history. The mind recoils from the effort to foresee the details of such a calamity, and from the careful explanation of the unavoidable uncertainties as to whether people would die from blast damage, from fallout radiation, or from starvation during the following winter. But the fact remains that nuclear war is possible, and the possibility of nuclear war has formed part of the foundation of international politics, and of U.S. policy, ever since nuclear weapons were used in 1945.

"The premise of this study is that those who deal with the large issues of world politics should understand what is known, and perhaps more importantly what is not known, about the likely consequences if efforts to deter and avoid nuclear war should fail. Those who deal with policy issues regarding nuclear weapons should know what such weapons can do, and the extent of the uncertainties about what such weapons might

The journal Ambia presented a special issue on Nuclear War: The Aftermath Ambio, 1982]. The introduction contains this statement: "... the impact of a nucle ar war would be far more devastating to the biosphere than any other threat that is likely to appear in our time. And the likelihood of such a war occurring does not seem to be tlimitiishing." I believe tliat this S Our moral obligation a meinbers of the hitman race to present our scientific conclusions at broad-based mectings in which the cthical, social, and political issues are also considered. However, these combined issues are so complex and controversial that they should be sponsored by organizations other than AGU.

The history of arms-control talks [e.g. York, 1983) teaches us that scientific data and conclusions provide a fundamental basis for the agenda and technical agreentents. The session of the 1983 AGU Spring Meeting in Bultimore on detection and evaluation of underground nuclear explosions is an important example of the value of un upen forum. Let us hope that the AGU aession at San Francisco will lead to general acceptance of a body of acientific facts and reasoned speculations on the serious geophysical and geochemical consequences of nuclear war, and that political and diplomatic leaders will be able-to use this information to negotiate agreements for safeguarding the human race.

Key Literature

An extensive scientilic literature on the effects of single nuclear explosions inclucles Glossione and Dolan [1977]. This is an authoritative review based on observations in 1945 of the two small nuclear explosions (10-20 kilotons) above Hiroshima and Nagasaki, and on many test explosions up to 50 megatons above and below land and sea surfaces mainly in good weather. Although the engineering of nuclear weapons is complex, the scientific principles of fission and fission-fusion-(fission1 weapons are well known. If the type of weapon and position of detonation are specified, the physical and chemical consequences in the first few seconds and minutes can be estimated fairly accurately. Thereafter, the consequences depend considerably on the meteorological conditimes; in particular, the wind drift of a debris cloud, and especially the possibility of rain-induced fallout, must be considered. As the height of the detonation increases, there is less disturbance near the ground and an increasing degree of ionization in the atmosphere. Large amounts of nitrogen oxides and other gases are produced, and a high-altitude explosion will reduce the ozone conventration in the stratosphere. Dust in the upper troposphere and stratosphere can remain suspended for months or years, and the recent data on volcanic ejecta from Mount St. Helens and El Chichón are relevant in regard to the geographic extent and rate of dispersal over the entire earth. A tutorial on the effects of nuclear explosions over Detroit and Leningrad Is given in an Arms Control and Disamantent Agency report on The Effects of Nuclear War; and Office of echnology Assessment [1980] examines offects of an explosion over Washington,

northern hemisphere; hot-spots, not in

the immediate vicinity of nuclear-explo-

sions, would be 2 to 3 times more intense

The production of 1036 molecules of NO

would be 5-50 times greater than the nat-

amount of ozone. About 107-10a tons of

ural amount in the stratosphere, and

might cause a 2-fold reduction in the

dust might be injected into the strato-

sphere, and simple comparison with the

Krakatan eruption would suggest a tem-

perature decrease of about half a degree

earth. All these conclusions were tentative,

particular, all models were too simple, and

Inclusion of the effects of smoke and

toxic gases from huge fires indicates se-

vere consequences. The summary in Crni-

of forest will go up in smoke-corre-

mass of Denmark, Norway, and Swe-

dustrial centers, fires will also rage

els (mostly oil and gas) will be de-

across croplands and it is likely that at least 1.5 billion tons of stored fossil fu-

stroyed. The fires will produce a thick

sntoke layer that will drastically reduce

the amount of sunlight reaching the

earth's surface. The darkness would

agricultural activity in the Northern

This conclusion is based on a nuclear ex-

change of 14,700 weapons totalling 5700

megatons. Most of the weapons would be

smaller than I megaton and most of the

troposphere. The soot from the fires

would amount to a lower mass than the

nirrogen oxides would be deposited in the

persist for many weeks, rendering any

Temisphere virtually impossible if the

war takes place during the growing sea-

sponding at least to the contbined land

den. In addition to the tremendous fires

that will burn for weeks in cities and in-

As a result of nuclear war vast areas

and further study was recommended: in

Celsius over the mean surface of the

synergism might be important.

zen and Birks [1982] states:

reviews the evidence on hoge impacts on the earth throughout geologic time, with emphasis on the Cretaceous-Tertiary global extinction. J. S. Chang lists possible global effects of a nuclear war and discusses the assumptions and uncertainties in models which predict a 50% destruction There are fortunately no observations of the protective ozone layer. J. W. Birks on multiple nuclear explosions during a short periud (several hours), but there are and J. Staehelin evaluate the air quality following a nuclear war, with emphasis on several published scenarios involving varidie components Initrogen oxides, carhon ous numbers of weapons aimed at ntilitary mounxide, hydrocarbons) for a photoand civilian targets. A report on the Longcliemical smog. Interaction with smoke is term Worklwide Effects of Multiple Anchen discussed, and a detailed simulation is givll'enpons Detonations [National Academy of en for a one megaton airburst over Den-Sciences, 1975] has considered atmospheric ver. J. B. Knox presents a synopsis of the effects (radioactive fallout, photochemical studies at Lawrence Livermore National effects, temperature effects, climatic impli-Laboratory on radiation fallout, ozone decations), natural terrestrial ecosystems, pletion, and smoke-dust-gas mixtures. managed terrestrial ecosystems, the aquat-The importance of the moisture and temic environment, somatic effects on huperature profile for self-induced rainout of radioactivity is discussed. Synergism remans, and genetic effects on ltumans. Chapter I, by J. P. Friend and others quires further study. niade a thorough evaluation of the almo-R. P. Turco reviews the sources of atspheric effects expected for a nuclear exchange of 10⁴ megatons in the northern hemisphere. Simple scaling, to the effects of the ahove-ground nuclear explosions diat were conducted before the test ban, produced an estimate of average cumula-tive fallout of 1 Curie/km² of 90Sr in the

mospheric dust and smoke in a nuclear exchange, and uses evidence from manmade and natural phenomens. He concludes that fires from major urban center: alone could cause major atmospheric dis-turbances. In a follow-up paper, O. B. Toon, T. P. Ackerman, and J. B. Pollack present calculations on severe loss of stinight from a large and even a sninli unclear exchange with consequences intermediare between those for large volcanic emptions and the Cretaceous-Tertlury event. Substantial alteration of the dynninical

airborne debris from Krakatan or Mount

St. Helens, but the black carbon would ab-

sorb light much more strongly than vol-

canic glass. Hydrocarbons would combine

with other gases to produce a photochemi-

cal smog. All the proposed effects are dif-ficult to quantify because of uncertainty in

the starting parameters je.g., a thick snow

cover would reduce fire risk, and would

be vaporized to produce a wet atmo-

sphere; a turbulent atmosphere would

and chemical processes of the atmos-

All-Union Session at San

Francisco

promote early fallout); in the dynamical

pheres; and in the accuracy of computer

Several scientific groups are tackling

it was decided to conrentrate on their

these complex atmospheric problems, and

work in the all-Union session at San Fran-

cisco. The morning session, in the International Room of the Cathedral Hill Ho-

tel, is deliberately designed for the entire

membership of AGU and invited guests

from the public information services. All

processes and conclusions without resort

to unneressary jargon and detail. An af-

ternoon session in the Crystal Room of

the Holiday Inn will concentrate on the

I will present an introduction and over-

view at the outset of the morning session.

To produce a reference point, the second

paper by T. J. Ahrens and J. A. O'Keefe

details of the atmospheric processes.

speakers will concentrate on the major

processes in the atmosphere should occur. S. H. Schneider gives a summary of the application of general circulation models by a group at the National Center for Atmospheric Research. Intense heating of the mid-atmosphere would occur from absorption of solar radiation by soot, frost patches might occur at any season and latitude, and changes of circulation patterns might increase the southward transport of oactive debris. P. W. Crutzen concludes the morning session with an overview which will emphasize the interrela-

tionships between the various processes. The titles of the papers to be presented fternoon session are as follows (see Eos, November 8, 1983, for full meeting details): Stratospheric Ozone Reduction at Early Times on Subcontinental Scale; Chemical Response of the Troposphere to Smoke, Dust, Smog and Ozone Depletion; Climatic Effects of Spreading Smoke and Dust; Generation, Physical Properties, Atmospheric Dispersion, and Effects of Smoke Following a Nuclear War; The Role of Short and Longwave Radiative Forcing in the Climatic Effects Due to Nuclear War; and Influence of Physical Processes in General Circulation Model Slmulations of Massive Atmospheric Soot Injec-

Further AGU Activity

The Public Affairs Committee of AGU will continue its activity via a subcommittee on Geophysical Aspects of Nuclear War and Arms Limitation chaired by Jared L. Cohon (Eas, October 11, 1983, p. 585). Future all-Union sessions may be desirable to cover (1) the fale of radionyclides in the water and solid materials at the earth's surface; (2) the nature of the

electromagnetic pulse and its relation to innization processes in the atmosphere; and (3) new simulations of the atmosph ic processes discussed at San Francisco. The 1984 AGU Spring Meeting at Cincin nati might he suitable, and potential contributors are invited to write to me ss soon as possible (or phone 312-962-8110, Thursday or Friday morning preferred). Other Activity

Several groups are working on the consequences of nuclear explosions. A group headed by G. W. Carrier (Harvard) is expected to sulmit a report shortly to the National Academy of Sciences, and an International Seminar on Nuclear War was held at Erice, Italy, this summer. I should be grateful for information on other adia-ities.

Acknowledgments

Thank you to Carroll Ann Hodges, chairman of the AGU Public Affairs Com mittee, for asking Tom Ahrens and me to organize the all-Union session at San Francisco. And many thanks indeed to all the speakers for giving so much time and psychological energy to their presenta-tions. I am particularly indebted to Paul W. Crutzen, Joseph Knox, Michael McCracken, Stephen Schneider, and Richard Turco for sn much detailed advice about speakers and topics.

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and the arms race, Sc. Am., 149-160. October 1983,

Joseph V. Smith
Department of Geophysical Sciences
The University of Chicago L'hicago, 11. 60637

Transactions, American Geophysical Unio The Weekly Newspaper of Geophysics

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Editor-in-Chiefi A. F. Spilleaus, Jr.; Editors Marcel Ackerman, Mary P. Anderson, Peter N Bell [News], Bruce Doc, C. Stewart Gilmor [History), Clytle C. Goad, Arnold L. Gordon, Louis J. Lanzeroul, Robert A. Phinney, Mana-ing Editore Gregg Forte; Editorial Authorit Kaihleen M. Lafferty; News Writert Barbara T Richman; News Assistant Tony Rekshardt Production Staffr James M. Hebblethwalte, Da Sung Kim, Patricin Lichiello, Lisa Uchtenstein,

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American Geophysical Union 2000 Florida Avenue, N.W. Washington, D. G. 20009

Cover ISEE-8 orbit in the earth's distant magnetotail during 1983. A new technique was used to achieve two lunar swing-bys to increase the satellite's observation time in the distant tall. See news 2 ticle this issue. (Figure courfesy of Tycho you Rosenvinge, NASA Goddard Space Flight Center.)

News (cont. from p. 429)

effects will be felt by farmers who import waterthrough irrigation, although even liere the report suggests that long-term impacts may be countered by new developments in cultural technology. Despite their confidence in the global

varning trend, the NRC committee report is oriskled with caveats. If, for example, delorengino is a bigger factor in the buildup of CO2 in the atmosphere than is now believed (making fuel use a relatively smaller factor), the authors warn than their model would be seriously flawed," and the predicted rise in COrlevels probably would occur more slowly. On the other hand, if atmospheric increases for other "greenhouse gases" such as nitrous addesed chlorolluorocarbons are factored in theo the buildup may be faster. And, given the uncertainties of future fuel consumption patterns and pulitics, the committee has much less confidence" in their prediction of regional dimatic changes or the social and ic implications of those changes.

The NRC study was ordered by the Energy Security Act of 1980, which called upon the White House Office of Science and Technolo-Policy to request the National Academy of ciences to assess the global COz moblem so that Congress neight make a more informed decido on synthetic fuel development. The committee favors continued study of atmopheric CO2 and the greenhouse effect but no immediate changes in policy. "There is reason for caution, not panic," in the words of chairman William A. Nierenberg of the Scripps Institution of Oceanography. The report concludes that no near-term plans for educing consumption of fossil fuels would either be justified or effective in solving the problem. "Viewed in terms of energy, global ollition, and worldwide environmenta lamage, the 'CO2' problem appears intractable," the report states. "Viewed as a problem of changes in local environmental factors . . . he myriad of individual incremental problens take their place among the other stresses

to which nations and individuals adapt." The NRC report, entitled "Changing Climate," followed by two days an Environment tal Protection Agency (EPA) report that reached the same conclusions as to the inevitability of a CO2-related global warming uend, but differed slightly on the timetable. In the EPA prediction, the climate would notically warm up somer than in the NRI. Mean temperatures would rise 2°C by the per 2040, and 5° by the year 2100.-Th

DOE Geosciences Research

The Department of Energy (DOE) supons research in the geosciences at 25 uniresity campuses as well as at the motional laboratories and the National Academy of Scitare (NAS). Funds but the program have grown sharply since 1969, when the total for sity research amounted to \$483,000. The last 3 years have seen unijor funding in treases. The total was \$3,026 million in 1981, \$141 million in 1982, and \$4.519 million in 1933. Grants to individual investigators ranged from a low of about \$10,000 to a high of about \$337,013 in liscal year 1983, and the Sisonoo

Most of the university projects have to do with genthermal systems: mechanical properties of rocks, magnias, and transport of fluids in rock systems. A few studies are related to thermochemical properties of synthetic silicale materials. The projects seem to be fooused on the general problems associated with geothermal sources and with radioactive vasie storage, but the studies range from up-

O transport, and modeling.

per atmosphere measurements to organic rhemistry and to structural geology.

The Geosciences Research Program at DOE supports studies by the Committee of Seismology, the U.S. National Committee for Geodynamics Conmittee, Continental Scientific Drilling Committee, and Geological Sciences Board of the NAS National Research Council. These groups set up national initiatives and report

un national geological needs. The research categories supported include geology, geophysics, and earth dynamics: geochemistry; energy resource recognition. evaluation, and development; hydrologic and marine sciences; and solar-terrestrial-atmospheric interactions.—PAIB

GRL Plans Issue on Arctic Haze

Arctic haze, a winter-spring air pollution phenonienon in the Arctic, has recently become the focus of accelerating research interest. In the spring of 1983 alone, at least seven atmospheric research aircraft from four nations were involved in studies related to Arctic haze. Extensive ground measurements of haze parameters were conducted by five countries with interests in the Arctic.

These and earlier programs have produced new and exciting information covering a diverse range of topics. To assut in the overall study, interpretation, and dissemination of these data in a timely manner, a special usuel section of Geophysical Research Letters will be dedicated to the subject of Arctic haze and related meteorological/atmospheric studies.

Publication is planned for the spring of 1984.

The deadline for submission of papers is December 31, 1983. All papers will be subject to the normal GRL size limits, page charges. and review criteria as set forth in any recent issue. Guest editor for this special issue is:

Dr. Russell C. Schnell NOAA/GMCU Boulder, CO 80303 FTS 320-6661 303-497-6661 Telex: 45897 SOLTERWARN

Please maily the guest editor may if you plan to submit a paper to this special issue. Before the end of 1983 send lour copies of ron manuscript to the guest editor; one copy to the ERL Editorial Office, 2455 Hayward, Ann Arlan, MI 48109; and one copy to AGU, 2000 Florida Ave., N.W., Washington,

JGR Papers on LAGEOS

AGU is inviting contributions to a spe cial issue of the Journal of Geophysical Re-search (JGR) deroted to the results from malyses of Laser Geodynamics Satellite (LAGEOS). Examples of topica approp ate for the issue include, but are not limit-(1) Geodesy: gravity field, intersite

baseline distances, polar motion, earth tides, and satellite orbit perturbations (2) Tectonophysics: tectonic plate moion, crustal deformation, gravity and geold interpretation, and mantle convection, structure, and rheology (3) Solid earth-ocean-atmosphere inter

All analyses should be based on LAGEOS data or make extensive use of LAGEOS data along with other informa-tion. Peer review of all papers will be in accord with the usual JGR standards. Pa-

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University of California, Los Angeles Los Angeles, CA 90024

Authors should advise Cohen by December 31, 1985, of their intention to make a contribution. He can be reached at the above address or by telephone at 301-

Geophysical Events

This is a summary of SEAN Bulleton, 8(9), Suptem ber 30, 1983, a publication of the Smithsonian Insti-tution's Scientific Event Alert Network. The entire Miyakejina and Rabard reports are shown; the ke report is an excerpt. The complete bulletin is available in the microfiche edition of Fos as a microfiche supplement or as a paper reprint. For the microfiche, order document E83–409 at \$2.50 1U.S.) from AGU Fulfillment, 2000 Florida Avenue, N.W., Washington, Dt. 20009. For the paper re-print, order SEAN Bulletic (giving volunce and issue numbers and issue dated through AGU Separates at the above address; the price is \$3.50 for one copy of each issue mumber for those who do not have a deposit account, \$2 for those who do; addit copies of each issue number are \$1. Subscriptions to SEAN Bulletin are available from AULT Fidfillment at the above address; the price is \$18 for 12 month-ly issues mailed to a U.S. address, \$28 if mailed elsewhere, and must be prepaid.

Volcanic Events

Kilanea (Hawaii): 8th-10th major phases of E Rift Zone eruption; lava formains to 30lt m feed Hows to NE and SE

Mt. St. Flelens (Washington): Lava Iron new vent added to compassie dome Veniaminof (Alaska): Eruption resumes: stromboliou activity; lava flows Pacaya (Guatemala): Strombolian Intras and

lava llows in summit crater Una Una (Indonesia): Satellite observations of July-August eruption clouds Miyakejima (Japan): Tephra cloud to 10 km; lava flows

Rabaul (New Britain): Earthquake swarms and uplift at intracalders cone Langila (New Britain): Explosions, tremor from gas venting; glow seen twice

Manam (Bismarck Sea): 4 days of stronger activity, ashfalls to 10 km Papua New Guinea: Gas measurements at 4

Pagan (Mariana Is.): Small plume emitted Atmospheric Effects: El Chichón cloud re-

mains over mid-latitudes Miyakejima Volcano, Izu Islands, Japan (34.08°N, 139.53°E). All times are local (=

GMT + 9 hours).Miyakejima erupted on October 3 after 21 years of quiescence. Two hours of increasing

seismicity preceded the eruption onset. A col umn of tephra and vapor rose to 10 km, and lava flowed down the SW flank.

Small carthquakes began to be recorded at the Japan Meteorological Agency (JMA) Miyakejima Weather Station at 1358. Weak shocks were felt at the same time in Ako, the largest village on the SW coast. Seismicity in-creased gradually, and from around 1450 to 1523 as many as 2-3 earthquakes per minute were recorded. The first felt shock (JMA intensity 1) at the weather station occurred at 1448, followed by others at 1500 (JMA 2), 1514 (JMA 11, and 2 at 1522 (both JMA 2). Many more shocks were felt in Ako.

JMA personnel judged that the eruption began at 1523, when the amplitude of recorded continuous tremor began to increase and high amplitudes persisted for hours.

The eruption began in the summit crater

(Oyama), and downslope along a 3 3-km-long fissure from the summit to the SW coast. Lava fountains rose to a few hundred meters from more than nine vents. The lava advanced in five flows, 300-400 m wide, starting forest fires in many places. The inrgest low reached Ako and a smaller one reached Usuki village about 1800; 90% of Ako was destroyed but there were no castralties. Lava reached the sea about 1900.

The pilot of a Japanese nirliner reported that an eruption column had reached 10-km altitude around 1600. Tephra covered the entire, 55-km2 island. Tephra was thickest or the E half of the Island, where 20-30 cm of ash and lapilli accumulated; many car windshields were broken. In the SW sectur, 7-8 cm were reported. The airport was closed by the clouds of tephra and about 7.5 cm of ash and fist-sized tephra on the runway. Rescue

and fist-sized tephra on the runway. Rescue planes en route to the island had to return to Tokyo Airport.

Speciacular fountaming and frequent loud explosions commued until midnight. An underwater explosion at the SW end of the fisture was observed from a fishing boat about

0

Climatić Changes

by M.I. Budyko (1977) inglish translator, R. Zolina

262 pp • extensive bibliography • \$24

This clessic volume discusses the principal leetures of modern cilmete end climeles of the paal.

Budyko discueses the effects of climatic changes on biologicel processes, including the evolution of living organisms end examines apecilic ellerations in micro as well ea mecro c)imetic conditions. The euthor present tha nead to develop methods - and offers suggestions - to modify the earth's climata. Climatic Chenges ia must reading for ell those interested in climete and climatic modification

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2330. Activity subsided during the night and only voluntinous white smoke was observed on October 4. There were press reports of a new island off the S coast but these were not confirmed by scientific sources.

Between the oaset of the emption and 0100 on October 4, 59 left earthquakey were recorded. Earthquake activity, which had declined at the onset of the emption, resumed at 1812 and increased gradually. At 2233 a magnitude 5.7 (M_s) shock struck the island. Preliminary USGS data placed the event at 34,06°N, 139,45°E, at shallow depth. The shock caused landslides at about 10 places along island roads, and was felt weakly in Totwo and throughout the Kanto district on Honshu, 180 km in the N. Alter this earthquake, seismic activity decreased through Oc-

Three felt earthquakes and a series of weak events of different character from those that preceded the eruption occurred heiween 1700 and 2100 on October 5. About 3000 earthquakes including 109 felt shocks had been recorded on Miyakejima from late 1982 through January 1983.

When die emption began, island residents fled to schools and other buildings designated as shelters, but 30 were forced from the Tsubota town hall (3.5 km SE of the sommit) when the roof began to collapse under the weight of tephra. About 2000 residents were moved from the endangered area near the eruption zone to the N coast. There were no casualues. Eleven government ships arrived to stand by in case the entire island population of 4400 needed evacuation. About 10% of the population left the island on October

Although heavy rain on October 5 cooled the lava, a stream that threatened the 60 remaining buildings in Ako continued to advance about 1/3 nt per hour. On October 6 firemen tried to halt it by spraying water on

Mivakeiima's most recent eruption was August 24-27, 1962, when explosions and lava flows originated from fissures running down the NE llank. In the 13 recorded eruptions since the year 1085, Ako was destroyed or badly damaged in 1648, 1712, 1763, and

Information Contects: Office of Volcanic Observation, Seismological Division, Japan Meteorological Agency, 1-3-4 Ote-machi, Chiyoda-ku, Tokyo 100, Japan; Tokiko Tiba, National Science Museum, Department of Geology, 3-23-1 Hyekunin-clus, Skinjukuku, Tokyo 160, Jopan; The Japan Times, To-kyo, Japan; Kyodo News Service, Tokyo, Japan; Agence France-Presse; Deutsche Pressegentur; Associated Press; United Press Internations

Rabani Galdera, New Britain Island, Papua New Guinea (1.271°S, 132.203°E). The following is a report from Peter Lowenstein.

"An exponential increase its seismic activity in Rabaul Caldora began in late August and culminated in an intense crisis with 621 earthquakes on September 19. The stronges event had a magnitude of ML 4.2. Since then seismicity has remained high at 40-120 events per day and has included several minor crises. The total number of caldera earthquakes in September was 2135, which is a sig-

News (cont. on p. 932)

nificant increase over the previous highest monthly totals of 1170 and 1079 in January and March 1982. "The earthquakes have been concentrated at depths of 0-3 km near Tarurrur Volcano, a small post-caldera cone on the E section of

"Tilt measurements showed distinct uplift centered 1.5 km S of Tavurvur. Uplift com-

the elliptical caldera bounding fault, but oth-

er sections of this fault have also been seismi-

Earthquakes

cally active.

Gravity

Reviewed by L. E. Wilcox

for the current edition.

rams will be missed

	Time			 	Depth	
Date	(UT)	Magnitude	Latitude	Longitude	of Focus	Region
September 7	1922	6.3M	60.99°N	147.39°W	shallow	S Alaska, USA

Information Contact: National Earthquake Information Service, USGS, Stop 967, Denver Federal Center, Box 25046, Denver, CO

C. Tsubui, George Allen and Unwin, Buston,

slv + 254 pp., 1983, cloth \$40, paper \$19.95.

According to its preface, Gravity is intended

to provide a fundamental knowledge about

earth. The material included is based upon

lectures given at the University of Tukyo by

the author with ailded results ubtained after

his retirement from the naiversity. The book

was originally published in Japanese in 1979

and was translated into English by the author

C. Tsuboi was Emeritus Professor of Phys-

ics at the University of Tokyo mulil his death

early in 1983. Throughou his career, he was

an active worker in the areas of gravity mea-

surcinent and interpretation. His contribu-

The coverage of the subject of gravity pre-sented by this book is reasonably comprehen-

sive. Most of the fundamental concepts of

grarity are treated-some quite briefly, some

for an undergraduate geophysical audience, but geodesy students might benefit by read-

ing some of the elementary yet interesting

The selection of topics discussed in this

book is a little different that I have seen in

similar books, and it may be useful to sum-

The book hegins with a brief but excep-

gravitation, centrifugal force, the geoid, and

the Ectyos effect. Toward the end of the

chapter, the purposes of gravity measure-

ment are stated to he [1] determining the

shape of the earth, (2) finding the under-

ground mass distribution, 13) estimating the

ues change with time, and (5) standardizing

physical and chemical constants. All but the

last of these topics are discussed later in the

text, but most attention is given to the second

The chapter on gravity measurement emphasizes the pendulum methods (absolute,

relative, submarine), with separate sections on

ballistic absolute gravity measurements, gravi-

meter measurements, and surface ship mea-

The free-air and Bonguer reductions and

elementary manner in the chapter on grarity

The cummutation of flattening there called

terrain correction are treated in a clear and

reduction. The approach here is decideally

ellipticity) from gravity is developed with ref-erence to the calculations of Newton, Huy-

gens, and Clairaut. Methods for computing the gravitational effects of underground

masses are discussed for a number of simple

The potential of gravity is briefly introduced and Laplace's equation is set up in car-tesian, cylindrical, and spheriral coordinates. This equation is solved for the cartesian and

cylindrical cases only. Methods to compute geuid heights and dellections of the vertical

are presented for each of the three coordi-

nate systems. Fully une third of the book is

deruted to the solution of Laplace's equation

and various topics on interpretation of earth

Another chapter covers second derivatives

of the gravity potential, the torsion balance, and their applications. A good introduction to tidal variations in gravity follows. A short discussion of nontidal gravity changes is in-

The book concludes with a clear discussion

of isostasy and its implications to gravity and earth structure, a chapter on the behavior of

structure using related methods.

cluded liere.

Į

geometric shapes and figures.

geophysical in autlouk and methodulogy.

elasticity of the earth, (4) seeing if gravity val-

tionally clear introductory chapter that de-

scribes the elemental concepts of gravity,

approaches taken by the author.

marize its major contents.

more detail. The book is clearly intended

standing the geuphysical structure of the

gravity and the use of gravity data for under-

Meteoritic Events

Fireballs: Brazil: Georgia, Massachusetts, mid-Atlantic, North Dakota, Oklahoma, Oregon (4), USA.

gravity at sea with simple structural interpre-

tation examples, and a chapter on interpreta-

tions of gravity in areas characterized by rol-

Throughout the text, its urlgin in lecture

mues for the University of Tokyu is clearly

apparent. For example, many of the specific

examples given pertain to Japan and its sur-rounding waters. In addition, the selection of

material presented and depth of coverage of

various topics suggest a course designed to be

a survey of the geophysical aspects of gravity.

Historical methods and procedures may be

emphasized too much at the expense of more

modern techniques. For example, consider-

balance measurement, while falling hothy

methods and gravimeters receive relatively

able space is giren to pendulum and torsion

brief coverage. The satellite methods of gran-

ity determination are mentioned only in pass-

The coverage of gravity-related topics is fundamental and basically elementary. Most

of the material presented is clear and concise

and should be comprehended by a nonspe-

cialist. I found the book fun to read and to

contain a number of interesting approaches

and topics that I have not seen in print else-

source for those experienced in gravity appli-

cations, and an excellent and reasonably com-

prehensive introduction to the geophysical as-

nects of gravity for those who are new to this

L. E. Wilcox is with the Defeuse Mapping Agency Aerospace Center, St. Louis, AIO 63118.

Daniel S. Barker, Prentice-Hall, Englewood

"Igneous Rocks was written for undergradu-

ate geology majors who have had a year of

alogy ... and for beginning graduate stu-dents. Geologists working in industry, gov-

ernment, or academia should find this text

useful as a guide to the technical literature

up to 1981 and as an overview of topics with

which they have not worked but which may

hare unanticipated pertinence to their own

projects." So starts the preface to this text-

igueous rocks, especially as they relate to

such a book with this arowed purpose in a

As one who works part time in research on

college-level chemistry and a course in univer-

Igneous Rocks

Cliffs, N.J., 417 pp., 1983.

Reviewed by Bruce R. Doe

where. I feel it is an interesting reference

Still, the material is very coherent and flows

camps and earthquakes.

menced in early September in relation to in-

creasing seismicity. A sharp tilt change of up

tu 49 microradians accompanied the seismic

since returned to normal. The depth and in-

crease in rohime of the source of ground de-

formation are estimated to be about 1.7 km

Government Volcanologist, Rabani Volcano Observatory, P. O. Box 386, Rabani, Papua

Information Contact: P. Lowenstein, Senior

crisis of September 19, but tilt rates have

and 1.9 million cubic meters."

drology of the newly established hydrology program at Tarleton State University, a part of the Texas A&M University system. He is one of four full-time water scientists and en-

The newsletter of AGLI's Committee on the History of Geophysics reports that Sylvio Fries, a research associate professor of history at the University of Maine, has been appeninted to serve as director of the National Aeronautics and Space Administration history office. The position has been racant since Nuvember 1982, following the retirement of Monte Wright.

Walter Sullivan, science editor of The New York Times, received the Association of Earth Science Editors' Award for Outstanding Editorial or Publishing Contributions. The award was presented at the association's meeting in mid October. Sullivan has been a member uf

field that has a choking richness of evolving terminology and a bewildering volume of in-

terdisciplinary literature. In addition to the

book contains a chapter on the role of igne-

its value to geothermal energy, and the pa-

tential of igneous rocks as an environment

for nuclear waste disposal. These topics are presented rather apologetically in the pref-

ace, but the author is to be applauded for in-

cluding this chapter. The apology shows just

how new these interests are to perrulagy. Rec-

ognition is finally coming that, for example,

mineral deposits are not "sports of nature," a

view held even by many economic geologists

as recently as the early 1960's; instead they

are perfectly ordinary geochemical features

formed by perfectly ordinary geologic pro-

cesses. In fact, the mineral deposits and their attendant alteration zones probably have as

much to tell us about igneous rocks as the ig-neous rocks have to tell us about mineral de-

The author also might well have had a chapter on the role of igneous perrology in

Mount St. Helens (brielly membracil in the

text) to some extent has bruken unr feeling

can't happen to us. The Chichon explusion in

Mexico (that erupted after this book went to

pen to us and even underlines a need for the

ability to predict which cruptions will be sul-

fur rich tlike Chichon) and which will not

(like Mount St. Helens) because of climate

modification aspects of sulfuric acid in the

Elsewhere in the last few hundred years,

individual volcanic eruptiums have resulted in

tens of thousands of deaths as a result of ash-

fall burial, tidal wares, and, especially, crup

failures in Italy, Iceland, and particularly in-

donesia. Volcanic activity also produces high seismicity—the Island of Hawall is the most

tectonically active area in the United States.

portant role that volcanism plays in climate

view of the recent Geological Society of

The author, alsu, too easily dismisses the int-

modification and the onset of glacial ages, in

America Special Paper on the topic [Axelood, 1981]. Perhaps a future edition of Igneous

Rocks will include a chapter on these volcanic

hazards because they are not just a topic for

There is a vast amount of material in the

417-page book that is helpful. There are dis-

cussions of komatiites, photomicrographs of

textures to accompany textural explanations,

and details on calculating various factors

entiation index, Peacock alkali-lime index,

stratisphere.

press) has reminded us again that it can hap-

that, in the conterminous United States, it

ologic hazards concerns. The explosion of

ous activity in the genesis of mineral deposits.

standard topics of igneous petrology, the

Soudra Toye, executive ufficer for the Na tional Science Foundation's (NSF) Office of Scientific Ocean Drilling (OSOD) for 2 year is the new program director for NSFs Ocean Drilling Program (ODP), OSOD was transferred in NSF's Division of Ocean Science eather this year (Eas, July S, 1983, p. 443); the Advanced Ocean Drilling Program (AODP) has been renamed ODP. Other mil in ODI' are Alexander L. Sutherland, assour prugram director; Hermon B. Zimmerman, program associate for science coordination and Jennieve D. Gillooly, program assistant Anion L. Inderbitzen, former OSOD program manager for science, has transferred to the science section in NSF's Division of Polar Pre-

Eorl W. Burrell, Hil, clied on August S. A. menuher of the Atmospheric Sciences section he juined AGU in 1948.

oseph IV. Howe, &I, client on October IR 1983. The professor emeritus of hydraulic engineering at the University of lows had juined AGU in 1938. A member of the Hydrulogy section, he was a Life Member.

Vlodimer Sobolev, 75, died. A member of the Volcanology, Geochemistry, and Petrolegy section, he joined AGU in 1972

that are bandled about so freely in igneous

time rescarcher to remember).

petrology but which are so hard for the part

One illustration of the difficulty of working

in igneous perrology regards rock dassifica-

tion. After taking us through the labryring

of the highly involved IUGS[1973] repon or

"Plutonic tricks, classification and nomenda-

ture" and the just-as-involved classification of Streekeisen [1978], the author tells us (p. 98)

that "the most wirlely accepted classification

of roleanic rocks is that of Irvine and Bangar

[1971]." However, their method "is too in-

valved to be summarized here." Thus igne-

ous-rock terminology is now in the state of

being too complex to include in even a 417-

page introductory text on the topid Not only this, but the definitions of terms can change

radically. As an illustration of this problem

when I slid some research on the origin of

and Hal Prostka in the 1960's, a shoshome

was a basah containing oliving and pyrosent

phenorysts with K-teklspar in the ground-

mass. Now the author recommends the term

be distuissed because (p. 281) "unusus po-

tassium-rich latue should be called an men

ally potassium-rich latite." The author repeat

edly shows his awareness that igneous petrol

ogy is tripping over its own teors; in fact,

one of his goals is to use this book to guide

terminology usage in the future, a noble but

probably futile endeavor. I offer the two ex-

amples above of the terminology problems to

show why I felt the need of a book like Igar

The back contains a few words on just

almut all topics and terms used in igneous pe

trobegy. [Not all terms in popular use are dis

cussed, however; for example, I looked in

valu for boinites.) Such a comprehensive con

erage is bound to be oneren, and sometime

the impression from the term incompatible t

ments that the geochemistry of lead follows

that of the umper elements magnesium, iron

and calcium, and that lead therefore would

usually be computible in the crystallization of

malic Ignemus rocks; lu fact it follows potass

nun mid tu senne extent sodium, elementi of

less limic charge but of more similar ionic ra-

dius. These elements tend to stay in the melt

and therefore usually incompatible for make

Another misleading use of terminology is

large ion elements, which for some region is

substituted for large ion lithophile elements or

LIL elements. No cloubs this change is a part of

but the students are going to be faced by till elements in the literature. Furthermore the author accounts the comments of the

ble elements and feels that the term incompatible

the author's terminology-reform movem

thor equates the terms large ion and

mislending. For example, une could easily get

ous Rucks.

shostomites with my colleagues Zell Peterman

Geophysicists

Roger J. M. De Wiest has been appointed ished professor and threetor of hy-

gineers in the new program.

Mohammed Asad Khan, a University of Hawaii professor of geophysics, recently was ap-pointed Pakistan Minister of State for petroleunt and natural resources.

ongus. An incompatible element is one that onjus. An accuracy in a meh that has any par arferentially stays in a meh that has any par arferial assemblage of phases crystallizing. Thus an element may be compatible in incomsable depending on the phases crystallizing at the time. A targe ion lithophile element, on heather hand, is one that stays in the muli when common plusses of the mantle crystal-Fre-divine, pyraxenes, spinel, and garnet. The term LIL element is therebre more re-

folopes are covered to some extent. Stronnum isotopes are the 1810 klb use in this text and are abruptly intruded into channer 7 under the heading of magmatic assimilation (p. 187) and, later, of nendyminm isotopes 1 jt. 278). Oxygen isotopes are introduced on p. 234 Lead isotopes are mentioned only in g. A better approach might well have sees to have a short chapter near the heginning explaining how these isotupes work, with applications introduced later where ap-

The author states that igneous petrology is by necessity, a descriptive science. Perhaps so, but I find die recent attempts to construct quantitative models to be healthy—as the unnor also states. In view of this, there is a surprising lack of equations in the text, although equations for equilibrium partitioning of use elements in generalizing differentiation trends and (although it is not labeled as such) for Rayleigh distillation are giren in a figure on p. 84. I had hoped to see more of these quations within the handy covers of one book but they are not provided. Just why these equations are absent is not clear, as they are all "plug-in" equations easily handled by a modern, \$15 pocket calculator possessing exonemial key, logarithm key, etc. They are udly beyond the grasp of present-day high school students, much less advanced undergraduates. Even the equations of the form of the radioactive-decay equation $(-dN/dt = \lambda N)$ are absent, in spite of the discussion of radiogenic isotopes. Because equations of this form—radioactive decay, first-order reaction rates, absorption of X rars, etc .- are autong the most commonly used in science, upperdamen and beginning graduate students should be familiar with them. Unlike many textbooks, Igneons Rocks dues not have problens or questions at the end of the chapters.

If the author 100 easily dismisses the possithe role of volcanism in ice ages (p. 205), the auggenions Jp. 147) that "it scents unlikely that the entire thickness of the crust can be pietred by a single pool of magnia constantly changing composition and burning its way opered seems even more premature in view ditte paper by Ahern et al. [1981] proposing is this. The contrurersy involving the origin agranitic and rhyolitic mehs is not clearly preented anywhere; yet, the discussion of hevariable coles of crustal anatexis by malic nels versus fractional crystallization of matic

a leasure that is helpful in underlining the

mon raient points the author wishes to get

melis to form granites and rhyolites remains In spite of these and other shortcomings. discussion of igneous rocks in any sort of

comprehensive and organized fashion be-tween two covers is a formidable job in the 1980's. It takes a comageous individual to make the attempt to do so. A review that fitcuses on the shortcomings of such a complex topic is all too easy to write. I did get-and, in fact, will continue to get for some time to conje-most of what I wanted out of this bouk. If I felt that many important references have been omitted lamong the 600 that are ritedl), there are many important references that I had missed and am glad I now know about le.g., the cited references on how much partial melting might be needed to permit druplets of magina to migrate and coalesce). In view of the increasing importance of igneritis petrology to society and the au-thur's recognition of this, many readers will final Igueous Rocks to be raluable.

spirited after decades of study.

Aliern, J. L., D. L. Turcone, and E. R. Oxburgh, On the upward migration of an intrusion, J. Geol., 89, 421-432, 1981. Axelrod, D. I., Role of roleanism in climate and evolution, Geol. Sor. Am. Spec. Pap.,

185, 59 рр., 1981. Irvine, T. N., and W. R. A. Baragar, A guide to the chemical classification of common volcanic rocks, Cau. J. Earth Sci., 8, S23-584, 1971,

IUGS (Internation Union of Geological Sciences) Subcommission on the Systematics of Igneuus Rocks, Plutonic rocks, classification and nomenclature, Geotimes, 18, 26-30, 1973.

Streckeisen, A. L., Classification and nomenclature of volcanic rocks, lamprophyres, carbunatites and melilitic rocks, Neues Jahrb. Mineral. Abh., 134, 1-4, 1978.

Bince R. Doe is with the U.S. Geological Survey. Reston, 1'A 22092.

Circulation in the Coastal Ocean

G. T. Csanady, D. Reidel, Boston, x + 279 pp., 1982.

Coastal ocean dynamics as a distinct branch of dynamic oceanography has seen a tremen-dons amount of growth in the past 20 years or so. Although there remain many areas of contention, a sufficient amount of common understanding now exists in the open literature that a synthesis is worthwhile and indeed welcome. Circulation in the Coastal Ocean represents an effort to accomplish just that. The emphasis is on motions in the cuastal ocean that cause large net particle movements and

is therefore particularly appropriate for the current concerns for the envionment. The scope of the moungraph is, however, much more limited than first expected. The resuler is led through the development of theories and physical arguments essentially following the impressive list of literature contributions from the author. The gravitation toward the works of one man precludes discussions of

other important topics and approaches. The monograph is organized into two main sections, following an opening chapter that briefly summarizes some fundamentals. The first section is composed of four chapters [2-5] and deals exclusively with the inertial response of the coastal ocean forced by the suddenly imposed surface wind stresses. 'f he discussion of the set-up process in chapter 2 is particularly chicidating and informative. The treatment in chapter 3 of the stratified occan response in terms of intlividual rertiral modes is elegant. The fact that solutions to the homogeneous poiblem can now he transcribed to give the behavior of a stratified coastal sea (albeit of a uniform tlepth) makes for an effective presentation.

The uniform-depth restriction is relaxed in chapter 4. The possibility of rurticity wave is introduced here in a way that is quite convincing. The discussion of coastal jet over a sloping beach is, however, not up to the standard of clarity of the early chapters. The chapter ends will a cursory look at cuastal trapped wares in a stratilied ocean with rariable depth. The development of the theory i followed in chapter 5 by a discussion of observational results from two major experiments: the International Field Year on the Great Lakes, on Lake Ontario, and the Coastal Upwelling Experiment off the Oregon coast. Comparisons between theoretical understanding and observations are, however, largely qualitative. Results of statistical analysis which has comributed greatly to the explosire development of the field are sorely

The second main section contains the rest of the monograph and is concentrated upon the equilibrium state of affairs in which the external forcing is halanced with dissipative processes, chiefly bottom friction. The discussion of the parameterization of hottom friction features a unique blend of empirical re-sults and conceptual understandings. The outcome is a solid formulation for a formulation of the horion stress that should prore useful in practice. The main attraction is, powerer, the analog of the spread of the sea lerel variation within a coastal boundary layer tu the conduction of heat. It brings a large body of analytical tools to bear upon the coastal ocean circulation problem. The discussion in chapter 7 of the thermohaline circulation features the author's work on the geostrophic adjustment problem for a botioni-to-surface coastal ocean from and the advection and diffusion of freshwater. The final chapter presents observational evidence for the steady-state circulation depicted in

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theory, particularly, that in chapter 6, but in a goalitative manner.

Other than the somewhat uneven quality in presentation that was alluded to earlier, the monograph also suffers from having numer ous printing errors. These errors are quite a distraction to reading and hopefully will be eliminated in later efficiens.

Some readers will no doubt be disappuint ed with mit finding here any discussion of numerical modeling results. While the author is correct in his assessment of the role of numerical modeling as mainly one of synthesizing analytical results, the value of numerical mulels in suggesting new directions for theoretical development and in providing a means fur experimentation is nunccessarily down-

On the whole, the manograph remains a rahiable and timely contribution to coastal dynamics literature. The incorporation of a substantial amount of the work on the Great Lakes is particularly of value. These enclosed basins provide succinct examples of coastal dynamics, yet are often given less attention than they descre.

As a text for graduate courses, the monograph could be broadened with discussions of mixing across fronts, tolal mixing, and perhaps further aspects of coastally trapped waves. For the professional, the book presents a bampier of physical insights and will prove to be a delightful addition to any shell.

. Hsneh is with the Department of Occasingraphy, Florido State University, Fullahossec, FL 32306.

Correction

The review of Physico-Chemical Behaviour of Atmospheric Pollutants that appeared in Eos. August 2, 1983, p. 486, listed an incorrect price for the book. The correct price is \$78.

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Little Building, Ann Arbor, MI 48109–1065. The
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may be considered. nay be considered. The University of Michigan is a non-discrimina Princeton University/Faculty Appointment. The Department of Civil Engineering at Princeton University invites applications for a faculty appointment in the Water Resources Program beginning September 1984. Respondibilities Include graduate and undergraduate teaching in fluid mechanics, surface water hydraulics, and numerical methods, and development of and participadon in a research program related to surface and subsurface hydraulic and hydrologic systeots. Candidates must have a Ph.D. degree with demonstrated teaching ability and scholarship. Submit resume and three references to George F. Pinder, Chairman, Department of Civil Engineering, Princeton University, Princeton, NJ 08544.

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and many more of these involved schemes is misleading (p. 82). The terms are not syn-AMERICAN GEOPHYSICAL

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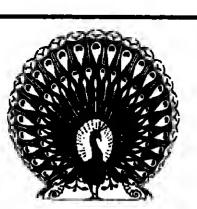
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indergraduate ond graduate programs in water resources at Case Western Reserve University are
managed through the Civil Engineering and Systems Engineering Departments respectively. Ocrause of the close interaction between the two programs, a juint appointment between the Systems
and Givil Engineering Departments is possible. At
the present, research in the water resource systems
engineering nea is focused on water planning,
management and polity analysis, hierarchicalmultobjective decision making, groundwater quality
management, risk assessment, and decision support
systems. The applicant should have a dectorate and
a strong interest in undergraduate and graduate
teaching as well as a contuitment to develop a
strong research program in his/her area of es pertise.

Please send a resome and names of references to: Professor Vacov Y. Halmes, Chairman Systems Engineering Repartment Case Westers Reserve University Crawford Hall

Cleveland, Ohio 44100 CWRU is an equal opportunity/affirmative action

Geophyaicist Tenure-Track Appointment/Department of Geology, University of Toledo. The position is effective September 1, 1984. Individuals with strong backgrounds in exploration geophysics—applied geophysics are of primary interest although other specializations will be considered. The PL-II, is required as well-at attention commitment to effective other specializations will be considered. The PLH, is required as well as a strong conntinuent to effective teaching and research. The department has modern facilities and offers B.S., B.A. and M.S. degrees to approximately off undergraduate and 50 graduate students. The faculty consists of eight bull time and five adjunct professors actively involved in a wide range of research pursuits. Interested persons should subant a letter of application, resume, transcripts, and three letters of recommendation to: Stuan L. Dean, Chairman all Search Committee, Department of Geology, University of Toledo, Tuledo, Ohio 4360B, phone (419) 537-2246 or (419) 527-2009.

University of Toledo is an equal opportunity/af-

Meteorologist/The City College of The City University of New York. The Department of Earth and Plauetary Sriences invites applications for an anticipated opening in meteorology. The appointment will atart September, 1984. Applicants should have completed the Ph.D. by the time of appointment and have a strong barkground in synoptic meteorology and computer applications. In addition, the individual should have an interest in atmospheric ritemistry or pollution as applied to urban areas, or physical oceanography. The person hired will be required to teach rourses in meteorology, and possibly physical oceanography as well as develop and maintain an active research program. Participation in the G.U.N.Y. Ph.D. Program in Earth and Salary will be commensurate with experience. Send resume, transcripts and three letters of reference by November 50, 1983 to Professor Dennis Weiss, Chairman, Department of Earth and Planetary Sciences, the City College, 138 Street and Convent Avenue, New York, N.Y. 10031.

The Cisy College of the City University of New York is an equal opportunity affirmative action ent-ployer.

University of Wisconsin-Miebigan/Hydrologic Modeler. The Department of Geological and Geo-physical Seciences at the University of Wisconsin-Mil-wauker invites applications for the whole the

physical Sciences at the University of Wisconsin-Milwaukee invites applications for a probable tenoretrack position of Assistant Professor beginning in
Fall, 1983, to join a broad program in hydrospherir,
geological, atmospheric and geophyaleal sciences.
Applicant's primary strength should be in the appliration of nomerical models to ground water flow
ant chensiral transport systems. A strong chemical
background or modeling eaperience with flow in
fractured media or contaminant migration would be
helpful. Further, ability to apply modeling techniques to problems in other aspects of the geoscienres will be important.

The successful candidate will be expected to teach
an applied senioe level course in the theory and ap-

The successful caudidate will be expected to teach an applied senior level course in the theory and application of finite element, finite elliference methods to problems of hydrology and geophysis. The entiddate is experted to develop additional graduate level courses in hydrology and to teach general geology at the undergraduate level. Ability to teach geophysical floid dynamics would be valuable.

Research programs at UWB include lake infiltration into aquifers, use of aquifers for compressedair sturage, Creat Lakes contamination and sediment processes, the use of applied geophysics in determining hydraulic properties and flow, and severe-storm modeling. Facilities include a Great Lakes Research Center with research vessels and pier facilities, an Urban Research Genter and a rursi field station.

Candidates should forward resumes, complete transcripts and three letters of recommendation to Professor D.S. Cherkauer, Chief. Desertments.

Candidates should forward resumea, complete transcripts and three letters of recommendation to Professor D.S. Cherkauer. Chair. Department of Ceological and Gcophysical Sciences, University of Wisconsin-Milwaukee, WI 33201. Salary range has not yet been formally aproved, but will probably be in the \$23,000-\$25,000 range. Closing date for applications is January 31, 1984.

UWM is an affirmative-artion, equal opportunity amplications.

Hamilton College/Faculty Position. Applications are invited for a tenture-track position starting September 1984 at the Assistant Professor Level. This position will expand the department front three to our farulty menthers. We seek a person with a PhD four family members. We seek a possure with a PhD who is strough or iented toward under graduate tearling and whose field of training and interests are in any of the fullowing helds: geophysics, low-temperature geochemistry, occaming afthy. Highly qualified randidates in whet areas will also be considered. The successful candidate will be expected to rontribute to introductory courses offered by the department, teach advanced under graduate courses, and maintain a research program.

Hamilton is a private, cochurational liberal arts college with 1600 students. The department has an active program with 10–15 majors in each rlass, excellent facilities and equipment, and a strong emphasis on field work.

rellent facilities and equipment, and a strong emphasis on field work.

Camilidates should send letters of application, resumes, transtripts, and three letters of recommendation to: Donald B. Potter, Chairman, Department of Geology, Hamilton College, Clinton, NY 13323.

Hamilton College is an equal apportunity employer. Women and minorities are encouraged in apply.

Ohio State University/Structural Geologist. The Department of Ceology and Mineralogy, The Ohio State University, invites applications for a tenure-track position for a structural geologist with a strong background in quantitative analysis of field data and research interests in regional tectunies or tectonophysics. The successful applicant will be expected to participate in the undergraduate program and give graduate courses in his/her field of expertise, conduct research, supervise graduate students, and interact with other departmental programs in regional geology and geophysics. Preference will be given to candidates with post-doctoral or industrial experience. Rank and salary commensurate with experience and research record. Please send applications or nominations as soon as possible to: s or nominations as acon as possible to

Dr. Ralph R.B. von Frese Clialrman, Search Committee Department of Geology and Mineralogy The Ohio State University Columbus, OH 43210 Phone: (014) 422-5635 or 422-2721

Applications should include a resume, a matement of research interests and the names of at least three persons whom we may contact for recommendations. The closing date for applications is December 23, 1983; appointmenta will be effective no later than October 1, 1984. Additional information ran be obtained by writing or calling the search containing

The Oltio State University is an equal opportuni-

Atmospheric Physiciat/Northern Arizone University. Temme-track assistant professor available January 10, 1984 (or August, 1984) in an eleven-man Physics Department with a joint appainment in Computer Science. Tearhing is at the undergraduate level with approximately one-liaff time devoted to teaching courses related to laboratory applications of computers. Knuwledge of FORTIGAN at least one assembly language, and fundamental digital logic is essential. Approximately une-liaff time will be devoted to teaching and research in Physics. Areas of research interest could include radiative transfer, mesocale dynamics, or ographic flows and/ transfer, mesoscale dynamics, orographic flows and/ or meterological/environmental instrumentation in-cluding remote sensing. Send a complete resume, statement of research interest and professional goals and names of three references to: Dr. Konneth Odell, Champerson, Department of Physics, Bux 6010, Nordiem Arizona University, Flagstall, AZ, 8011.

Applications received prior to November 30 will receive full consideration. Ph.D. required. Academic salary range \$20,000–25,000.

NAU is an Affirmative Action/Equal Opportunity

Igneous/Metamorphic Petrologist or Structural Geologist/Hobart and William Smith Colleger. The Department of Geogracies of these private, cognitute, idieral arts colleges seeks applicants for a future, tenure-track, position for september, 1984 for moral a held-oriented, ignores or metamorphic petrologist or structural geologist, a person communitor exterior in tracking and to stimulation of metagraduate research. Ph.D. required and teaching adoate research. Ph.D. required and teaching experience desirable. Teaching brindes introductory contress, uniterabagy, petrology and structure phase partiripation in the Colleges general carriedinm. Research encortaged and supparted. Submit Vitae and three letters of recommendation to Docabil L. Windraw, Department of Geoscience, Hobart and William Smith Colleges, Genera, NY 14356. Applications from women and members of minoring armys encouringed.

groups encouraged.

Hobert and William Smith Colleger are equal oppurtunity/affirmative action employers.

Moteorologist/U.S. Department of Commerce.

The Geophysical Fluid Dynamics Laboratory of NOAA in Princeton, NJ seeks a scientist with a background in aliagnostic studies of the amospheic general circulation system. Research involves application of modern analysis methods, e.g., spectral, empirical orthogonal function, and space-line was analysis to observational atmospheic and oceanizatas for estracting diagnostic information on the behavior of atmospheric general dreutation and dimote responses. The incombens performs definite comparative studies of the results from long fluid integration of complex and comprehensive dimar models. Pusition is in the competitive service and will be lifled at the GS-13 level with annual salary range of \$44,930 to \$45,406. Qualifications B.S. or higher degree in meteorology with three or more years of professional experience which shows possession of selective factors. One year of experience must have been comparable to the CS-12 level in the Federal service. Graduate education may be admitted in part for experience requirements. Selective Factors: HKnowledge of atmospheric general circulation theory and climate dynamics in global and regional climate systems, including large-scale transient eddy properties and the role of local sources and sinks of momeroum, kinetic energy, and heat and vorticity in maintaining stationary components of climatic structore. 2)Knowledge of the methods of comprehensive model building. \$1Knowledge of modern data analysis techniquese.g., spectral, empirical orthogonal function, spacetime wave propagation—us applied to large, hierogeneous data sets. To Apply: Current or former recleral employees soluut SF-171, CD-569, and OPM Form 1280. For borns call (3034-497-6332 or FTS 3291-6312. Others submit a GN-1300 package and Form 13801, Irath obtainable from Federal lob Information Ceruters. Send to NOA-AMASC. Fersonard Div (AT/MC25), ATTN: Mr. M. Mann, 33 Broardway, Houther, CO 80303, Var. No. MASC/ NDA-AMASC. Formous and 1900 package and Capar former forme CALL FOR EXTENSION. An Equal Opportunity Employer.

Geophysica-Tectonophysica/University of Wyaming. Applications are invited for a tenure tradiustion at the Assistant Professor Level in the Department of Geology and Geophysics, Candidate should have tracelong and research interests in adarcas as tretonopolesses, the successful applicant will join an established Ph. II. level geophysica program Dates will include teaching undergraduate and graduate level grouphysics courses, and establishing a nigrous research program, Excellent opertunities east for competation with mathematics the Mathematic Department includes a strong nomerical method group with interests in geophysics. Send resonae transcripts and three letters of recommendation by January 15, 1984 to Peter N. Shive, Dept of Geology/Geophysics, Pto Box 3006, University of Wyoming, Lanamie, WY 82071.

The University of Wyoming is an equal opportunity/allicinative to tion employer.

RESEARCH FACULTY POSITION

DEPARTMENT OF OCEANOGRAPHY NAVAL POSTGRADUATE SCHOOL

An (adjunct) research feculty position in physical/dynamical oceanography is immediate ly available; it is expected to continue for several years. A PhD in physical oceanography. meteorology, geophysical fluid dynamics, applied methemetics, physics or engineering is required. The position is dedicated to a program, in synoptic/mesoscale ocean prediction over an open domain, called OPTOMA (Ocean Prediction Through Observations, Modeling, and Analysis). OPTOMA is a joint NPS/Harvard program, aponaorad by ORR, which has been in progress for a year-and-s-half. A series of ocean prediction experiments in the addy field of the California Courted Out. the eddy field of the Celifornie Current Ayelem le plenned over the next several years. The scientific responsibilities of the position involve: (1) running simulations and prediction experiments with, and evolving, the Harverd statistical-dynamical (a quasi-geostrophic model interecting with a stalletical objective analysis) model, (2) participating in assigning, reallime ocean prediction experiments, often as a chief acisnilat, (3) conducting data analysis etudies, and (4) developing leadership in the physical interpretation of synoptic/mesoscale cesses. Hence, a strong background in ocean dynamics and an active involvement in numerical modeling are required. In summery, this is an important scientific opportunity to someone interested in combining synoptic work at see with theory and numerical model-

Assets of the Department Include a research vessel with ready access to an exciting the gion of the ocean, free access to an ISM 333 with excellent graphics capabilities, and proximity to the Fleet Numerical Oceanography Canter and the Naval Environmental Prediction Research Facility. Links exist to NORDA, the Naval Oceanographic Office, other Nevy lebs, and NOAA articulars Nevy lebs, and NOAA activities, as wall as other scademic institutions. Allogether, there are over 100 practicing physical oceanographers and meleorologists in the Monterey stee. Finally, the Monterey area has apectacular climate and scenery.

We will welcome applications on a continuing basis. However, the initial closing data will be 9 December 1983. Send a curriculum vitae; stelement of professional interests; and names, addresses, and lalaphona numbers of at least three references to:

> Professor Christopher N. K. Mooers Chairman, Oceanography Department, Code 68Mr Naval Postgraduate School Monterey, CA 93948 Telephone: (408) 646-2678

The Naval Postgraduets School is an Affirmative Action/Equal Opportunity Employer.

Indity University/Igneous or Metamorphile Petrologist. The Department of Geology at Trimity University is seeking candidates to fill a termine trank position with a specialty in Igneous or metamorphis perology beginning Angus, 1981. The appointment will be at the Assistant Professor level and the antidate pous possess the Ph.D. decree. Primin perology beginning Angular Professor level and the ment will be at the Assistant Professor level and the anglate must possess the PLLD, dequer. Priority will be given to those individuals with expertise in spiral mineralogy and petrography. This position requires a person with a extunition in to excellence in teaching as well as a desire to engage in an outgoing research program. Teaching will be at the undergraduate level and will include courses in playsical gology, petrology, and optical mineralogy. Thirty this erist y is an independent privately apported institution romantited to excellence in the fixed arms and selected professional programs indeeding engineering. Present entuilment is \$1000, of which \$250 are undergraduates. The Department of Gology has five faculty members and lifty undiens. Triany is located in San Antonio, Texas, a metomodian area of approximately one midlion. ASU iv an EO/AA employer.

irs. Triniy is located in San Antonio, Texas, a motopolian area of approximately one million.

Cooling date is Jenuary 15, 13184. Applications should include a resume, recent transcript, and the mans of three references, and should be sent on Robert L. Freed, Search Camminee Chairman, theorement of Geology. Trinity University, 715 Stadious Drive, San Antonio, Texas 78284.

Trinity University is an Equal-Opportunity/Albranity-Action Employer. Teas A&M University/Depoty Department Head.

The Department of Occaring raphy in the Codlege of Geordeness at Texas A&M University is sweking a depary department head in assist in the academic and administrative functions in the Department. Dutes will involve 75 percent administration and 25 percent research or reaching on a 12-mouth, appointment basis. This is a tenutry track position and will be filled at an arademic level commensurate with the experience of the applicant. Applicant must have demonstrated administrative ability, an embished record in research and an interest in and take demonstrated administrators and the making at both undergraduate and graduate levels of Oceanography. Closing date for applications is 15 December 1993. Effective date of this appointment silbe I January 1984.

TAMU is an equal opportunity/affirmative action

University of Texas at Austin/Getty Chair. The Department of Geological Sciences seeks a person at the rank of full professor in occupy the recently endoated Getty Chair effective September 1, 1984. Teaching obligations include one undergrand care or graduate routie early sensester and the supervision of graduate students in the areas of the person's interest. A willingness to teach courses for non-majors on occasion is desirable. The person's lickly of research must be one that is related in a broad scuse to the exploration for hydrocarbuis. The terry endoamen will provide the chair holder with modest foods for support of travel and research activities. Applicants should submit a detailed resture, manner and addresses of five references, and a statement of apparents mount submit a detailed restune, nature and addresses of five references, and a statement of teching and research interests by February 1, 1984 for Dr. Eatle F. McBride, Chairman, Department of Geograf Sciences, P.O. Box 7909, Austin, Texas 78312-7909.

The University of Texas at Austin is an Equal Opportunity/Affirmative Actions Employer.

Takka Sate University/Associate Director—Hydrology. Pan of the Texas A&M System, is offering a B.S. Degree in Hydrology as of the Fall, 1983 Season. This is the only such degree in the State of Texas The Associate Director we are serking must be an enthusiastic individual able to work with the Director in sharing the administrative load, and such program into regional and quantum from enter. This will be a termine-track appainting, rank and sidary negotiable, Ph.D. required. Satantal hundring available for Lo likites consumeron Applications are sought from outstanding hydrologys, water resources engineers and scientists. bu Applications are sought from outstanding hy-dologus, water resources engineers and scientists, olding hydrotoxicalogists. Applicants should and resume and manes of three references by Fri-nay I, 1984, no Dr. Roger De Viess, I furction of Bydology, P.O. Rox T-ft?, Talleton Stanion, Sephenville, Texas 76-102. Telephone 817-968-964 (63). Position must be lifted as of April 1, 1884.

Tadeton State University is an affirmative action, spal opportunity employer.

National Genter for Atmospheric Research/Ph.D. Researcher. NCAR's Atmospheric Chemistry and stronomy Division seeks experienced Ph.D. re-xacter with record of sustained productivity in desy and modeling of atmospheric chemistry. Primary interest is in gaseous photochemistry and rangled demical/meteorological models, but all specialists will be considered along with scientific hreadth. Appointment is at Scientist 111 or Senior Scientist Ird. Apply with resoure to Dr. R. Gicernne, Natural Center for Atmospheric Research, P.O. Box 390, Boulder, Calorado 80307, by Occember 20, 1833.

Equal Opportunity Employer M/F.

Research Observer/U.S. Department of Commerce. Position in Barrow, Alaska. Conducts scientific measurements at the NOAA Baseline Observatory in Barrow, Alaska. Will make measurements of atmospheric Co2, ozone, aerosols, other trace roustitures, and meteorological paranteters. This position is in electronics specialist (instrument). Responsibilities are talibration and maintenance of the Observacy intruments and NOVA minicomputer. We set applicants with electronics technician background with at least 4 years of experience or elertronic engineers with at least 2 years exporience. The experience so enough he specialized in electronic innies engineers with at least 2 years experience. The experience should be specialized in electronic insumentation calibration and maintenance.

This is a 15-24 month appointment. Duty station to the first two months will be in Boulder, Colorado for orientation and training, then at Barrow, Alasta, NOAA will supply bachelor quarters at reasonable cost in Barrow. The Observatory is within 6 files of Barrow, a community of about 2000 people. The measurements supply information for curient almospheric sessarch into climate and climate change. We offer an adventure as well as good salary about \$30,000-\$40,000 per year, depending ou qualifications and experience). For more information, contact Mr. Oernard Mendonca, U.S. Dept. of Commerce/NOAA, \$25 Oroadway, Boulder, Colorado 30303; telephone FTS \$20-0733 or Commercial \$351,497-6733.

NOAA is an equal opportunity employer. NOAA is an equal opportunity employer.

Excity Position/Arisona Stato University Department of Geology. Applications are invited for an antispated tenure-track faculty position at the assistant professor level, beginning in August of 1984. The selected candidate will be expected to display excelence in teaching and to develop a vigorous program of research on important geological probems. Possible research areas which would complement or extend existing attempths in the department belief solid earthferustal geophysics, selsmology, and mineral physics. Please send a detailed statement of research and teaching interests and a resumo with names of four efferences by January 15, 1984 to Paul Knauth, University, Tempe, AZ 85287

Arizona State University is an equal opportunity/affirmative action employer.

Atlsona Stote University/Geochemistry Research Specisilist. To operate and modify automated SFM lacility for period particle analysis in atmospheric geochemistry research. Software development and SEM/EDS experience necessary. Ph.D. optional, Lompetitive sikity. Send resume, statement of experience to personnel, Arizona State University, Tempe, Arizona 85287 and names of three references to Dr. P.R. Buseck, Depts, of Geology and Chemistry.

The University of New Mexico/Mass Spectrometry, The Department of Geology, University of New Mexico, Alburquerque is seeking applicants for a research associate position in the stable isotope laburatory. The position includes responsibility for operation and maintenance of mass spectrometers and high vacount extraction systems, sample preparation and isotopic analyses. The position also provides opportunities for collationative research in isotopic geothemistry leading to publication. A Ph.D. in geothemistry leading to publication. A Ph.D. in geothemistry, inorganic chemistry, or physical chemistry with research especience involving mass spectrometry and high vacount technology is required. Send a letter of application, resume, and the names and addresses of three individuals willing to serve as references to: Crayton J. Vapp. Department of Geology, University of New Mexico, Albuquerque, NM 87131. Closing date for applications is February 1, 1984. The availability of this position is contingent on load budget approval. ntingent on head budget approval.

The University of New Nextco is an equal oppor-

Louisiana Stote University/Chas. T. McGord, Jr. Endowed Professouship in Hydrocarbon Exploration: The Geology Department is seeking an internationally recognized leader in some research specialty critical to the search for on and gas to fill the Chas. T. McCord, Jr. Endowed Professorship. Applicants are expected to maintain scholarly research in their area of specialty. Bank at Full Professor level with salary competitive with endowed professorships at other major research universities. For consuleration send resonue, three loners of reference, and a description of future research programs to Lyle McGittnis, Faculty Search, Department of Geology, Lonisiana State University, Batton Rouge, LA 70803—1101. Search will remain open until position is billed.

tion is filled.
LOUISIANA STATE UNIVERSITY IS AN AI-FIRMATIVE ACTION/EQUAL OPPORTUNITY

University of Iowa/Faculty Positions. The Dr-partment of Physics and Astronomy anticipates two openings for tenure-track assistant professors or en-ing faculty at any level in August 1984. In excep-tional cases a term or tenured appointment at the associate professor or professor level will be consid-ered. Preference for one position will be given to an experimentalist in finer mediate or high energy physics. Current research interests in the depart-mentare tradio and optical astronomy and the lob-lowing specialties in physics; atomic, condement ma-ter, changing particle, laser, inclear, plasma, and space physics. Faculty duries inclode muleignathrate and graduaty trading, gindance of research stu-dents and personal tracearch, interested persons should submit a resume and a statement of research interests and arrange for three letters of recommendimensis and arrange for three letters of reconnection to be sent to Search Committee, Begardness of Physics and Astronomy, The University of Iona, lowa City, 1A 52242.

The University of Jowa is an equal opportunity

allumative action employer

Ohto State University/Seismologist-Tectonophysiciat. The Department of Geology and Mineralogy. The Dhio State University, inches applications for a tenure-track position for a geo-physicial with research interests in seismology and/ or tectomophysirs. The successful applicant must be prepared to assist in tencing exploration geophys-ies roorses, advanced topics in his/her specially, con-duct research, and supervise graduate stodents. Preference will be given to candidates with post-duc-tural or industrial experience. Rank and safary con-mensurate with experience and research record. Please send applications or nonlinations as soon as possible to:

Dr. Raluk R.O. von Frese Dr. Rajut R.D. von rese Chairman, Search Committee Department of Geology and Miteralogy The Ohio State University Columbus, O11 48210 Phone: (614) 422-5635 or 422-2721

Applirations should include a restune, a statement of research interests and the names of at least three persons whom we may contact for recommendations. The closing date for applications is December 23, 1083; appointments will be effective no later than October 1, 1984. Additional information can be obtained by writing or calling the search rommittee rhaltman.

The Othe State University to the search rommittee of the contact of the search rommittee.

The Ohio State University is an equal opportuni-

University of Wisconsin-Parkside/Tenure-track Position. The Geology Program at the University of Wisconsin-Parkside invites applications for a tenure-trock position at the assistant-professor level to begin in August 1984. The sucressful applicant will be experted to teach undergraduate courses in one or more of the following areas: hydrogeology, low temperature georhemistry, environmental geology; carry out a productive research program in his/her specialty; and share the teaching load in hunductory geology courses. The Ph.D. or equivalent is required. Submit a resume, transcripts, 3 letters of reference, and a statement of research and tearbing interests by January 31, 1984 to:

An AA/EOE m/T.

An AA/EOE m/I.

University of Rhode Island/Marine Research Associate III. A postdortoral research associate position is available starting January 1, 1984, for studies of the western Sargasso Sea from the subtrapical ronvergence to the Culf Stream. The research in-

rower genre to the Gulf Stream. The research involves the processing and analysis of sniellite thermal IR digital data. The primary scientific emphasis will be on mesocale near surface dynamics and on alrisen interaction in the region and will be campled to in situ data from several on going intejects. Facilities include dedicated VAX 11/780 image processing system with large historical digital data base and extensive data acquisition program of the Sargasso Sea. Submit resume and 3 professional reforences by December 15, 1985 to: Peter Cornillon, Maritte Research Associate 11† Position, UNIVERSITY OF RHODE ISLAND, P.O. Box 357, Kingston, Rhode Island 02881–0357.

Northern Illinois University is an affirmative a onequal opportunity employer.

Professor Gerald A. Fowler Geology Program University of Wisconsin-Parkside Box No. 2000 Kenosha, Wisconsin 53141

We will interview at the G.S.A. meeting in Indianapolis.
The University of Wisconsin-Parkside is an affirmative action/equal-opportunity employer.

Oregon State University/Fisheries Oceanography. Applications are invited for a 12-month, tenure-trark position as Assistant Professor in the College of Oceanography with a joint appointment in the Department of Pisheries and Wildlife. Applicant must have demonstrated ability to conduct independent research and obtain research funding in the areas of ecology of marine fishes or nekton. Workers with interests in ecology, fisheries oceanography, or population biology of nekton will be considered. Applicant must have Ph.D. Postdoctoral experience desirable.

Applicant must never the desirable.

The appointee will be expected to teach courses in fisheries oceanography or in the ecology of marine nekton, to supervise graduate students, and to develop a program of grant-funded research. Salary \$27,000-55,000, negotable. Application material; including a brief statement of research plans, and the names of three references, should be submitted not later than \$1 January 1984 to: G. Ross Heath, Dean, College of Oceanography, Oregon State University, Corvalia; Oregon 97381.

Affirmative Action/Equal Opportunity employer.

GEOCHEMIST/PHYSICAL INORGANIC CHEMIST

University of Oxford/Research Assistantishlp—Crade 1A. Salax (71):0-(11).0-7.
Applications are incired for a NERC supported Research Assistant-hip to investigate the use of satellite altituetic measurements in overatiography and help in the design of observing waters for the World Climate Research Programme. Use will be made of models of ocean circulation on the CRAV-1 componer accessed from the Oxford work station.

Candidates should ideally have a Ph.O. in geophysical Build dynamics, applied math or physics. The position, which is available to March 1986, will commence as soon as possible.

Applications, giving details of qualifications and research experience, together with the names and addresses of two referces, should be sent to Or. D.L.T. Anderson, Dept. of Atmospheric Physics, Clarendon Laboratory, Oxford OX1 3PU, by 25 November 1983. A postdoctoral position is available in the Chemistry Bickson of Argonine National Laboratory for a person with a background in geochemistry or physical inorganic chemistry. The research area modyes microcalorimetric and related studies of reactions important for the geochemistry of transuration elements. To apply, please send resume to: Walter D. McFall, Oox-D-CHAI-80, Argonine Notional Laboratory, 9700 South Cass Avenue, Argonine, fl. 60439.

An Equal Opportunity/Affirmative Action Finalizer.

Boston University/Faculty Position. The Astronomy Ocpartment at Roston University express to have a faculty position available beginning either January or September 1984, extending at least through the 1984/85 academic year. Applicants are sought who have teaching experience and who have a proven research record as evidenced by publications and recommendations. Research programs in the department include ionospheric and magnetispheric physics, galartic astronomy, and estragalactic and high energy astrophysics. Applicants with research programs in any of these areas will be considered; however, preference will be given to those with experimental or observational interests.

Equal consideration will be given to individuals wishing to atart in January or Septembee 1984. Oepending on the future availability of funds, this position may be comerted to a permanent line leading to eventual tenure. PHYSIGAL OCEANOGRAPHER/University of Rbode Island. The Graduate Srhovi of Oceanog raphy at the UNIVERSITY OF RHODE ISLAND invites applicants for an Assistant Applicance. raphy at the UNIVERSITY OF RHODE ISLAND invites applicants for an Assigant or Associate Research Professor position. We are particularly interested in candidates with theoretical or nonerical modeling experience in one or more of the following areas of recearch: geophysical Boid dynamics, dynamics of equatorial oceans, oceanic transport processes, and rimate and the oceans. Only limited atart-up funds are available so candidates must have a demonstrated ability to raise their own fonding. Please send application including a statement of research interests and names of three references by December 15, 1983 to: Professor Melviu Stean, Graduate School of Oceanography, UNIVERSITY OF RHODE ISLAND, Kingston, Rhode Island 02881.

to eventual tenurc.

Please send a curriculum viae, names of three persons whn ran provide an evaluation of your leaching and research and a brief statement of current research interests to:

Kenneth Janea, Chairman Astronomy Department Boston University 725 Commonwealth Avenue Boston, MA 02215 (617) 553-2027

Boston University is an Equal Opportunity/Affir-

POSITIONS WAN'TED

Geochemiat/geologist. Ph.D., 6 years of experience in trace element geochemistry, volcanology, hydrolliermal processes, water-rock insteraction, with field/lab techniques on land or at sea. Also teaching experience at university level. Seeks Research/ Tearhing/industrial position in the Washington, I.C. area, Resume our request. Americal Grophysical Union, 2000 Florida Avenuse, N.W., Bux 0111, Washington, D.C. 20009.

Chair/Northern Illinola University/Chair. Applications are invited for the position of Chair of the Department of Geology. We seek candidates who have an established commitment to research and who are interested in the challenge of leading a young and growing department which has just recently established a Ph.D. program. The department is committed to the furtisor development of a strong Ph.D. program and is looking for candidates who would shate that commitment. Wo seek the strongest possible candidates without regard to aperialty, however, candidates from the areas of hydrogeology, hydrogeochemistry or geophysics are particularly encouraged to apply.

Rank and salary for the position are negotiable, Send resume and statoment of interest to Dr. M.P. Weiss, Chair, Search Committee, Department of Geology, Northern Illinols University, DeKalb, IL. TRANSLATORS. Free laine, Rossian to English with expertise in adamology, tectoriles, mathematical aspects of geology, seronomy, dynastic meteorology or physical occanography. Excellesst knowledge of Russian and ability to write klomatic English required. Write to: Scripta Publishing Co., 7961 Eastern Ave., Silvet Spring, MD 20910.

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State University of New York obes not descriminate on the basis of race, sex, religion, national origin, age, physical disability or marital status, in admissions, biting, and treatment of either students or employees.

University of Mianti/Graduate Research Assistantiships in Physical Oceanography and Meteorology. The Division of Meteorology and Physical Oceanography, School of Marine and Armuspherie Science, University of Miami, invite applications from students in science or engineering with a strong background in physics and maltentatics and an interest in either the atmospheres, the ocean of their mounal interaction. Successful applicant may pursue either a M.S. or Ph.O. involving work in a wide range of observational/experimental or theoretical research. Remuneration includes toltion (\$5,280., first year) plus a yearly stipend of \$9,360. for applicants entering the M.S. program and \$11,050, for students in the Ph.D. program. Research Assistantiships begin I September, 1984, but summer research work may be available earlier in some accepted students. For detalls and/or application write: Dr. Friedrich Schott, Oivision of Meteorology and Physical Oceanography, Rosenstiel School of Marine and Atmospheric Science, University of Miami, 460th Rickenbacker Cswy, Miami, Fl. 33149. University of Mianti/Graduate Research

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A

The Engineering and Groundwster Committee of the Society of Esploration Geophyalcists—is sponsoring a session at the Fall 1984 S.E.G. Annual Meeting on 'Archaeologo and Geophysio'. The session is intended to include technical papers on the application of returne sensing and high-resolution ground geophysical medical in mapping and evaluating human cultural resources. A 1,000-2,000 word extended abstract will be required by May 1, 1984 by those interested in participating. Additional 1984 by those interested in participating. Additional information is available from:

Jeff Wynn, USGS 918 National Center Reston, Virginia 22**0**92, telephone: (703) 86**0**-6564

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For application forms contact: American Geophysical Union Member Programs Division 2000 Florida Avenue, N.W. Washington, D.C. 20009 (202) 462-6903

Application Deadline May 1, 1984

<u>Meetinas</u>

Meeting Report

History at 1983 **IUGG** Meeting

Perhaps because the 1983 1UGG meeting at Hamburg commemorated the 100th auniversary of the First International Polar Year, the 50th anniversary of the Second International Polar Year, and the 25th anniversary of the International Geophysical Year, it was a particularly appropriate for uni for the study of die history of space science. By any measure, however, the 18th TUGG Assembly marks a watershed in the study of history and its application to space physics and geophys-

Besides two highly successful sessions on historical events and on the use of historical records in research spansored by the IAGA Interdivisional Commission on History, several of the IUGG Union lectures and interunion sessions specifically addressed historical concerns. In particular, M. Nicolet's address I"Re(lexions sur l'Année Géordissique Internationale") and the opening remarks, which reminded the participants of the 1912 meeting in Hamburg of the Association Géodesique Internationale, revolved about historical

The excellent exhibit on the life of Affred Wegener, the "father" of continental drift, set the theme and generally high standards of the historical papers. The high point of the conference, huwever, for those interested in history was the excursion un August 20-21 to Göttingen and its environs—the location of

Gauss's most famous geophysical discoveries. It had been evident for the last 5 tu 8 years that interest in the historical events surrounding the growth of space science and geophysics and of the use of historical records was rowing in the 1UGG/IAGA commonity. Based on this interest, IAGA sponsored two sessions specifically devoted to the history of space physics and geophysics (chaired by W. Schröder) and the use of historical records in research (chaired by J. Feynman). Several pa-

pers stand out in both sessions. For example, Barraclough and his colleagues' papers on the use of historical magnetic observations in studying the earth's core and of Halley's Atlantic magnetic surveys indicate the existence of extremely valuable scientific records on the state of the magnetic field for several hundred years in the past.]. Feynman and P. Fougere demonstrated the existence of a sharply defined, 88-year perio-

dicity in solar-terrestrial phenomena. In the historical events session, typical examples of the quality of the papers were the detailed review by K. Bretterbauer of the roles that J. Payer, C. Weypreelit, and H. Wilczek played in the founding of internauonal polar studies. W. Dieminger discussed the extensive activities in ionospheric physics in Germany prior tu and during the Second World War. It should be noted that more than 30 to 40 persons were in attendance at every presentation and for the husiness meet-

Several other IUGG and IAGA sessions had papers devoted to historical issues. W. Olson gave a synopsis of the history of studies of the ionospheric and magnetospheric fields in his session on the separation of the observed magnetic field into main, ionosplienc, and magnetosplicne contributions. At the inter-union symposium on geophysics of the polar regions, G. D. Garland's introductory remarks and historical perspective and G.E.R. Deacon's review of oceanography and the polar years contained several fine references to the historical events associated with various fields. Also of interest were the IASPEI sessions on historical seismograms, other area where long-term historical rec-

ords are proving to be of great value. The 2-day trip to Glittingen included a visit to the Physikalisches Institut, where numerous early geophysical instruments of historical importance were exhibited for the tour, and the Institut filr Geophysik, where historical seismological instruments were still in active operation

This meeting report was prepared by Henry B. Garrett, who is with the Jet Proposition Laboratory, California Institute of Technology, Postidena, CA

Announcements

Geodynamics at AGU Spring Meeting

The NASA Geodynamics Program, incorporating the Crustal Dynamics Project, is being carried out in cooperation with soveral federal agencies and with participation by many researchers at universities. In government and non-government institutions, and

in the private sector. The annual review of research activities in this program draws more than 100 participants interested in the multidisciplinary, thematic discussions of ongoing research in space-related aspects of geodesy, plate and pular motion, tectonics, hudy physics, and geopotential fields. It was suggested, mutably by the AGU sec-

tinus on Geodesy and Tectomophysics, that the review, which is corried unt essentially in the format of a scientific meeting, might be of interest to the general membership ul AGU. At the same time, combining the review with AGU's annual Spring Meeting would save participants, most nl' whum nre members of the Union, valuable travel immey and even more valuable time.

For these reasons, it has been agreed to formulate geodynamics as a separate theme at the 1983 AGU Spring Meeting in Cincinnati. Sessions will be organized by a special chairman selected by the pertinent Section presidents. Contributions will be solicited for presentation in these theme sessions in the 1983 Spring Meeting call for papers, which appears in this issue. These contributions will involve interim and final results of research in the areas mentioned above, descriptions uf proposed and completed measurement campaigns, as well as discussions of development pertinent instruments and spacecraft sys-

Watershed Models at Fall Meeting

The Soil Water Committee of AGU's Hydrology Section will sponsor a session na evapouranspiration, soil moisture evolution, and aquifer recharge in watershed models, at the 1983 AGU Fall Meeting. The session will explore the manner in which the hydrologic enomena of evapotranspiration, soil muisture evolution (including interflow), aquifer recharge and aquifer return flows are treated n current (small) watershed and/or river basin models. Mure information can be uhtained from H. J. Murcl-Seytonx, Dept. of Civil Engineering, Colorado State University, Fort Collins, CO 80523 (telephone 303-441-

Urban Hydrology

The 11th International Symposium on Urban Hydrology, Hydraulics, and Sediment Control will be held at the University of Kentucky in Lexington, Ky., July 28-26, 1984. The deadline for submitting abstracts is Derember 31

Abstracts of 400 words or less on the fullowing subjects are invited: hydraulic infrastructures design, analysis, and approxing: urban water supply and distribution systems; the urban flood plain; social, legal, limmetal, and ecunomic aspects; and urban stormwater quantity and quality. Abstracts for minicourses (approximately 1 hours long) are also encouraget

For mure information, write Elizabeth Haden, Coordinator, Office of Continuing Education/Engineering, 223 Transportation Research Bldg., Univ. of Kentucky, Lexington, KY 40506-0043 (telephone: 60ti-257-3972).

Ice and Bacteria

The Second American Conference on Ice Nucleating Bacteria will be held June 11-9, 1984, at Northern Arizona University in Flagstaff, Anz. Pruceedings of the conference will be pre-printed and distributed at the meeting. The deadline for submitting abstracts is anuary I, 1984.

The conference will focus un current investigations and will include both poster sessions and oral presentations on such tupics as microbiology, genetics, biochemistry, plant pathology, aumospheric wurk, and other aspects of the problem of ice nucleating bacteria. Also scheduled is a field trip to the Grand

Suggestions for the conference are wel-come, including recommendations of individ-uals who should be included in the program. Representatives of technical firms are welcome if they are willing to exchange information openly. For more information, write:

Second American Conference on Ice Nucleating Bacteria, The Ralph M. Bliby Research Center, Box 6013, Northern Arizona University, Flagstoff, AZ 86011.

Longitude Zero

"Longitude Zero," an international symposlum to commentorate the 190th anniversary of the adoption of Greenwich as the location of the prime meridian, will take place at the National Marltime Museum in Greenwich, UK, July 9-13, 1984. Historians of astronomy are invited to discuss all aspects of the prime meridian, including navigation time keeping, geodest in a part of the second prime merician, including navigation of keeping, geodesy, astronomy, and the problems of the international administration of science.

Planned meeting ropics include longitude and meridians before the 17th century, 18th century meridians and the adoption of Greenwish, the geodetic aspect the develop mem of observatories during the 19th comry, international competation, the French claim, the influence of instrumentation on the development of science, and "toward In versal Time." A visit to the Royal Greenwith Observatory and a general session on the linory of astronomy also are planned.

The symposium is held under the auspin of the International Union for the History and Philosophy of Science and the International Astronomical Union. For more infermation, contact the conference officer, Logitude Zero" Symposium, National Mariûne Muscum, Greenwich, London SEO 9NF, UK

Correction

The report of AGU's Spring Meeting actihies (Fins. July 19, 1983, p. 464) incorrectly listed paper SA51-05 as undelivered at the meeting. The paper, "Concentrations of Mg and Fe Near 92 Km" by W. Swider, was deliered earlier in the meeting than originally

Geophysical Year

New Listings

A boldface meeting this indicates sponsorship or cosponsorship by AGU.

January 10-11, 1984 Computer Applica-tions in Mineral Exploration, Toronto, Canadic. Spousors, Toronto Geological Discussion Group, Geological Assoc. of Canada, Canada an Institute of Mining and Metallurgy, Cantdian Exploration Geophysical Soc., and As-soc. of Exploration Geochemiss. (The Orgamixing Committee, CAME 1984, do Samina Carrada L.d., Suite 2116, 130 Adelaide St. W., Turomo, Canada M5H 3P5i.

April 2-4, 1984 Second National Symposittin and Exposition on Groundwater Instrumentation, Las Vegas, Nev. Sponsor, Nation al Well Water Assoc. (NWWA). (D. M. Xidsen, Conference Coordinator, NWWA, 560 W. Wilson Bridge Rd., Worthington, OH

43085; tel.: 614-846-9355;. June 1-7, 1984 Symposium on Climate and Paleo limate of Lakes, Rivers, and Glaciers, Igls, Austria, Spinsor, International Communission on Climate, IAMAP, IM, Rubo, Institut Inc. Meteorologie und Geophysik, Schoophstrasse 41, A-6020 Innsbruck, Aus-

June 1-8, 1984 International Water Re-Surpces Association [IWRA] Seminar on River Basin Strategy, Linköping, Sweden, (U. Lolna, Water Theme, Linkoping Univ., \$-58183, Linköping, Sweden.)

June 6-9, 1984 Second American Confer ence on Ice Nuclearing Bacteria, Flagstall, Arlz. (The Ralph M. Bilby Research Center, Box 1011, Northern Arizona Univ., Flagstaff, AZ SIMILD.

July 9-13, 1984 Longitude Zero, Green wich, England. Sponsors, International Union for the History and Philosophy of Science and the International Astronomical Union. (Conference Officer, "Longitude Zero Sympositini, National Maritime Museum, Green wich, Loudon SEO 9NF, England).
July 23-26, 1984 11th International Sym-

posino on Urban Hydrology, Hydraulics and Sediment Control, Lexington, Ky. Spon sur, University of Kentucky. (E. Haden, Co urdinator, Office of Continuing Education Engineering, 223 Transportation Research Bidg., Univ. of Kentucky, Lexington, KY 49506-0043; tel.: 606-257-3972).

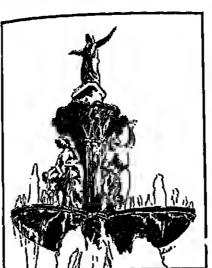
July 29-August 4, 1984 Eurogeophysic Assembly, Louvain-la-Neuve, Belgium, Spotsor, European Geophysical Society. (G. M. Brown, Dept. of Physics, Univ. College of

Wales, Aherystwyth, Wales, UK.)
July 31-August 2, 1984 Fourth Interna-July 31-August 2, 1984 Fourth Interna-tional Symposium on Stochastic Hydraulic, Univ. of Illinois at Urbana-Champaign. Spon-sur, International Association for Hydraulic Research. (B. C. Yen, W. H. Tang or G. E. Stout, Dept. of Engineering, Univ. of Illinois, 208 N. Romine St., Urbana, H. 61801; tel-217-333-0687 nr 217-333-0536)

August 13-17, 1984 12th International
Laser Radar Conference, Aix en Provence,
France, Sponsors, IAMAP and American des teorological Soc. (G. Megie or J. P. Granien Service D'Aéronomie du CNRS, 12th Inter-national Laser Radar Conference BP 3. 91870-Verrières le Bulsson, France).

Change

March 19-23, 1984 Fifth Northern 84 March 18-23, 1984 Fifth Northern 35
search Basis Synposium and Workshop,
Vicrumakl, Finland, (Charles Slaughter,
Vicrumakl, Finland, (Charles Slaughter,
Chalrman, U.S. Working Group, Institute of
Northern Forestty, USDA Forest Series
Northern Forestty, USDA Forest Series
Tonana St., Fairbanks, AK 99701, or Oli Fansanon, Secretary, Organizing Committee Hydrological Office, Box 436, 00101 Hesland 10, Finland.) New U.S. confact shoom.



Spring Meeting: Call for Papers

Abstracts must be received at AGU by ! P.M. on February 22 to be on time. Late abstracts (1) may be summarily rejected b program chairman, (2) may nut lie pub-lished in advance of the meeting, and (3) if accepted, will be charged a \$25 late fee in addition to the regular publication

The 1984 Spring Meeting of the American Geophysical Union will be held in Cincinnati, May 14-18, at the Cincinnati Convention Exon Center. Biocks of sleeping ronms are eing held at the Charion (former) Signifier's) and Netherlands hotels for those attending. Corresponding authors will he sem housing and registration forms. In addition, the forms will be published in Eos.

General Regulations

ejected automatically

Abstracts may be rejected without consideration of their content if they are not received by the deadline or are not in the prop er format. Abstracts may also be rejected it they contain material obtaide the scope of AGU adivides ur il they contain material already published or presented elsewhere. Only one contributed paper by the same first suther will be considered for presentailon; additional papers Juniess invited) will be

Only AGU members may submit an absact. The abstract of a monnember must be amapanied by a membership application fam with payment) or it must be spousored

by an AGU menther. There is a publication charge of \$40 (\$30 prepaid) for each abstract. The publication darge is \$20 if the first author is a student. and couributed papers are subpa to the publication charge. Prepayment of he publication charge can save pumey. Semi a theck for \$30 (\$15 for students) with your abstract. The alistract must be received at AGU by February 22 to avoid an additional \$25 charge. Abstracts not prepaid will be inwited prior to the meeting. Payments will be

AGU will acknowledge receipt of all ablizas. Notification of acceptance and scheduing information will be mailed to correpending anthors in late March.

Abstracts

The abstract mage is divided into two parts: the abstract itself and the submittal informaion Follow the instructions for both careful-Please use a carbon ribbon to type the maleral, and do not exceed the maximum dimensions (11.8 cm x 18 cm) of the abstract. burnets that exceed the noted size ilmitations will be trimmed to conform.

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2. Identification (only members may sub-mit an abstract; this includes invited authors): Type the identification number of one memauthor (ID number is the line consisting of four letters followed by the sor digits; see member'a mailing label on Eas or journals), or If no author is an ACU member, type the ID number of the member sponsor (sponsor's name must also appear on the abstract at the end of the author, portion). If no 1D number is given, a membership application and dues payment must accompany the abstract. Call

AGU immediately at 202-462-6903 if you need an application

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Poster Sessions

A large, centrally located meeting room will be set up for poster presentations. Experi-ence from At-U meetings and from other scientilic societies has shown that a poster presentation, while more demanding of the author, can provide a superb opportunity for comprehensive discussions of research results. Some sections are organizing poster sessions on specific topics, and contributed papers on these subjects will automatically be scheduled as posters. In other sections it may be necessary to assign papers to poster sessions even though their authors requested oral presentation.

Presenters of poster papers are reminded that a poster exhibit requires careful prepara-

tion. Figures and text should be scrutificized in detail, and authors must be prepared to discuss the contents of their papers in depth. Under these conditions, well-prepared figures and concise, logical text are essential

Program Committee

bleeting Chairman and Union (U) H. Frank Eden, NSF Atmospheric Sciences (A) Romald Lavoie,

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l'okanology, Geochemistry, and Petrology (V) Peter W. Lipman, USGS, Denver

Special Sessions

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Acid Precipitation cteorology and Atmospheric Chemistry of the Polar Regions

Geomagnetism and Paleomagnetism

Rock Magnetism Geomagnetic Methods Applied to Economic Resources Magnetic Anomaly Studies and the Structure

Georly transic Impliestions (G)

Magnetic Polarity Stratigraphy and Time Scales Irregularities in the Secular Variations and

Hydrology (H)

Symposium on Miscible and Immiscible Transport in Groundwater Symposium on Field Methods for Supporting

Groundwater Chemical Transport Models Measurement of Groundwater Transport Pa-

Ocean Sciences (O)

El Niño: Biology and Chemistry El Niño: Physical Characteristics Gulf Stream Dynamics Ocean Technology Response of the Upper to Very Strong Winds

Inland Seas Oceanugraphy of Straits and Sills Oceanic Sources of Atmospheric Trace Gases Oceans Monitoring Oceanigraphic Applications of EM Fields

SPR: Cosmic Rnys (SC)

New Techniques and Applications of Geomagnetic Effect in Cosmic Rays Studies

SPR: Magnetospheric Physics (SM)

Aprora and Substorms (Puster Session) Geomagnetic Pulsations Ionosphere and Plasmasphere

Geonagnetic Tail and Boundary Layer [Post-Magnetospheric Currents and Electric Fields

Numerical Simulation of Space Plasmas (Post-

Waves, Instabiblies, and Turbulence in Space Plasmas (Poster Session)

Other Themes

Geodynamics

Primarily designed as the annual review of the research activities of the NASA Geodynamics Program, the geodynamics sessions will also incorporate appropriate contributed papers of a multidisciplinary nature in areas such as space-related aspects of gendesy, plate tectonics and polar motion, tectorics, body physics, and geoporemial fields. All sessions in gentlynamics will be sponsored by the Georlesy and/or Technicultysics sections

Mineral Physics

If one of the following fields is covered in the broadest sense, regardless of the section to which your paper is submitted, please add on cour abstract, under number 5 of the submittal information, the plicase "For Mineral Physics Session," and one of the following helds: (1) playsual measurements on mixerals. (2) caboriments, (3) high-pressing uniteralogy, (4) defect structure studies, (5) mineral and solids equations of state, (6) quantum mechanics of solids, (7) spectral unioralogy. or 18) electrical measurements on namerals

Sample Abstract

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F. R. S. T. AUTHOR (School of Oceanogrephy, Hydro University, Watertown, Mass. 02172) S. C. N. D. AUTHOR (USGS, Woode Hole, Maee. 02543) (Sponaor: I. C. Alvin)

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blank lines between authora. (4) Undersoore the name of author who will

present paper. (5) If no author is e member of a oceponeor ecciety, type sponeor's name in capital and lower case lettere.

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Spring Meeting

AUTHO52536

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K. C. Yeh: Radio Science **Editor**

Advances in satellite technology and computer science have had the greatest impact on radio science in the last quarter century, according to Kung Chie Yeh, the new editor of Radio Science. Yeh, whose term began July 1 (Eos, April 12, 1983, p. 137, February 22, 1983, p. 73), is a professor in the electrical engineering department at the Univer-sity of Illimis at Urbana-Champaign.

An international authority on ior radio physics, Yeh also is known for his work on trans-ionospherie radio wave propagation as it affects earth-space communications and satellite navigation. Hehas been studying radio science for nearly 30 years.

Today, the higgest problem facing radio scientists, said Yeh in a recent interview with Eas, is that the region of scientific interest is "so vast that, even with current computer capabilities and the satellite sensing capabilities, it is not possible at the moment to foresee that we could sample the geophysical parameters with enough idensity and enough continuity in time." Yeh adılcıl that he thinks such breadth of sampling probably will not be possible for at least two ilecades.

Yeh said he does not anticipate any drastic changes in Radio Science, although he hopes to broaden the scope of the journal by including paners in new areas of the science. "We're always open for good contributions,"

Soon to be jublished in the journal are two special collections of papers: "Radio Probing of the High Latitude lonusphere and Atmosphere" aml "Multiple Parameter Radar Measurements of Precipitation." In addition, two special collections are being assembled. Veh soul. They are "Emissions From Particle Beams in Space" and "Beacon Satellite Stuilies of the Earth's Environment." Another special collection, proposed by immediate past Radio Science editor Akira Ishimaru, will be a sampling of papers from the recent URSI symposium held in Spain on electromagnetie

1.1

The University of Illinois granted Yeh a B.S. degree in electrical engineering in 1953; I year later, he earned his M.S.E.E. from Stanford University. From 1954 to 1958 Yell was a research assistant at Stanford, working on propagation problems in what was then the Radio Propagation Laboratory later re-named the Radioscience Laboratory and recently renamed again the Space, Telerommu-nications, and Radioscience Laboratory).

In 1958, after receiving his Ph.D. from Stanford, he joined the electrical engineering department at the University of Illinois at Urbana-Ghampaign. For 6 months in 1966 and again in 1976 he was a visiting professor at the electrical engineering department at the National Taiwan University in Taipei. In 1967 he was a visiting fellow for 1 month at the electrical engineering department at the University of Hawaii in Honolulu. Yeh was elected an associate of the University of Illinois' Genter for Advanced Study during the 1973–1974 academic year. In 1977 he was in-

vited by the Space Research Center of the Polish Academy of Sciences to deliver a sequence of lectures on motions in the iono-

Yell was an associate editor of Rodio Science from 1979 to 1981, and served as co-guest editur of the special issue "Radat Investigations of the Clear Air" in 1980. A member of the Solar-Planetary Relationships section, Yeh ioined AGU in 1960.

Questions about the journal, comments, suggestions, and papers should be sent to K. C. Yeh, Editor, Radio Science, University of Il inois, 1406 West Green St., Urbana, IL 61801-2991. Yeh's term as editor ends December 1986.—*BTR*

Section Candidates

Eas is carrying biographies and photo-graphs of all candidates for President-elect, General Secretary, and Foreign Secretary of the Union and for President-elect and Secretary of each Section. In addition, statements by the candillates for Union offices and for Section President-elect will appear. The sections and the date of the issue in which their material appeared are as follows:

Geodesy: Geomagnetism and Paleomagnetism August 30

lanetology and Planetology petition candidate August 30 and October 18 mospheric Sciences September 27 Tectonophysics October 11 Seismology October 18 Hydrology October 25 Ocean Sciences November 1 Volcanology, Geochemistry, and Petrology Novem-

The slate of candidates for all offices was carried in the June 21 issue.

Solar-Planetary Relationships: President-elect

Robert A. Helliwell A fellow of AGU since 1967; 63 years old. Professor of Electrical Engineering. Stanford University. Alajor interests: wave propagation and controlled VLF waveparticle interactions in the ionosphere and

magnetosphere, B.S. (1942) and M.S. (1943) in electrical engineerng, Stanford; Ph.D. in electrical engineering, ford, 1948. Stanford faculty since 1946. Fellow: AGU, AAAS, IEEE; member: NAS, Sigma Xi, Tau Beta Pi, Phi Beta Kappa; member of Advisory Board, Planetary and Space Science Journal; Acting Director, Genter for Space Sciences and Astrophysics, Stanford University; 89 publications, 52 published by AGU. Author, monograph Whistlers and Related Ionospheric Phenomeno. Served on Executive Gommittee, Polar Research Board of the National Academy of Sciences; past president, International Commission IV, International Scientific Radio Union (URSI); past chairman, Committee on Space Physics, Space Science Board of the National Academy of Sciences; Delegate-at-large, Commission H, URSI, Recipient: Antarctic Service Medal, National Academy of Sciences, 1965;

Appleton Prize, The Royal Society of Lon-The AGU Chapman Conference on

Natural Variations in Carbon Dioxide

and the Carbon Cycle Convenors: E. T. Sundquist and W. S. Broecker January 9-13, 1983 Innisbrook Tarpon Springs, Florida

Natural Variations in Carbon Dioxide and the Carbon Gycle will bring together geologists who are studying various aspects of corbon cycle history; geochemical modelers; and biologists, oceanographers, and meleorologists who are familiar with present and potential future relationships among the carbon cycle, almospheric CO2

Quesilons to be discussed at this conference are: What were the causes of carbon cycle variations? Hmv were they related to atmospheric CO₂7 Were they associated with climate changes consistent with the CO2/climate predictive models7 What are the long-term geochemical implications of fossil fuel CO27

The meeting will emphasize the geologic record, and will include overviews by experts on the application of ocean modeling, climate modeling, and the biosphere modeling to CO2 as well as sessiona emphasizing the geological record. Presentations will be organized around six time alices: the last 2,000 years, the last

20,000 years, the last 2 million years, the Cenozolc, the Phanerozoic, and the Preeambrian. Don't miss this exciting programi Registration and housing information will be available by November 30. To be placed on a malling list write: CO2 Meeting, 2000 Florida Avenue, N.W., Washington, DC 20009

(202) 462-6903. For program Information contact: B. T. Sundquisi, U.S. Geological Survey, 431-National Center, Reston, VA 22092 (703) 860-6083. Statement

"My objective is to maintain the present vigor of the AGU section on Solar-Planetary tionships and, if possible, to increase the level of intellectual exchange that takes place at the regular meetings of AGU. I would like to find solutions to some of the chronic problems of the annual meetings, including the overlap of similiar sessions. I am also interested in the debate about poster sessions versus regular sessions. I would like to explore the possibility that the advantages of both could be retained by some kind of combined presentation. For example, it might be possible to relate a poster session to a particular oral session through the use of selected chairmen. Another idea would be to consider limiting the number of slides that could be presented in the regular session so as to encourage the use of poster sessions for mure detailed presentations and discussion. "I would also like to explore the possibility

of bringing session chairmen earlier into the session planning process. Now the Chair is separate from the planning of the session, and hence has little input regarding the coutent and management of the session. If the Chairs were to assist in the selection of papers, they could then be expected to contribnte more fully 10 the discussions following each paper. They would also be in a better position to anticipate discussions for which extra time could be allowed. Now when an interesting or controversial question arises, it is often necessary for the Chairman to shut off debate at the critical point in order to keep the session on schedule. Since a primary purpose of the ACU meetings is to enhance our understanding of ongoing research, it is essential that critical discussion not only be permitted but encouraged."

Martin Wolt A member of AGU since 1961; 57 years old. Present position is Director of Physical Sciences at the Lockheed Palo Alto Research Laboratory. Areas of scientific interest include most areas of Space Plasma Physics, with particular emphasis on the diffusion of charged particles in railia-tion belts and aurora. B.S., California Institute of Technology, 1950; M.S., University of Wisconsin, 1951; Ph.D., University of Wis-

on History of Geophysics and a member of

the Subcommittee on Electronic Transmission of Publishable Data.

"The principal goals of AGU are to pro-

mote research in geophysics and to make the results of this research widely available. To

achieve these goals the Union sponsors scien-

tific meetings and publishes a series of jour-nals. The Union also conducts activities for

the professional benefit of its members such

as employment services and provides infor-

ficult decisions in all these areas, In publica-

tions, the technology of editing, composing, and transmitting information is developing

respond to this new technology, we should

keep abreast of the developments, monitor

programs of our sister societies, and be pre-

pared to move as required. I strongly support the current efforts of the Publications Com-

initiee to study this evolving field and to rec-

Ommend prudent steps to avoid the need for

any sudden changes in our publication pro-

"In the meetings area the West Coast in es

rapidly and will affect the traditional way

mation via Ear on the current events affecting-

"In the coming years AGU must make dlf-

Slatement

consin, 1953. Staff member, Los Alamos Scientific Laboratory 1953-1956. Lockheed Palo Alto Research Laboratory 1956 to present. Has published 64 scientific papers, 20 in AGU journals. Edited one book on auroral phenomena. Fellow of AGU and the American Physical Society and a member of AIAA.
Wisconsin Research Fellow 1950–1951, AEC
Fellow 1951–1953. Member of Organizing Committees for annual Advanced Study Instltutes in Space Science 1965-1976, Vice-Chairman of Gordon Research Conference on Space Plasma Physics 1979, Chairman in 1981. Member of the Advisory Committee for University of Californin Space Science Laboratory 1971-1977. Member Scientilic and Educational Advisory Cummittee for Lawrence Berkeley Laboratory 1983-present. Member NASA Management Operations Working Group on Solar Terrestrial Physics, 1977-1982. Served nn various NSF, NAS/ NRG, and DoD study panels. AGU activities are the following: Secretary Fall Annual meeting 1971 and 1972, General Program Chairman Fall Meeting 1973-1975. Member AGU Publications Committee 1978-1982; Chairman of Journals Board 1978-1980. AGU Meetings General Chalrman 1979-1982; currently a member of the Committee

Edward P. Szuszczewicz A Member of AGU since 1973: 42 years old. Hearl, Space Plasma Diagnoslics Group, E. O. Hu burt Genter for Space Research, Naval Research Laboratory. Major interests: Experimental space plasma

professional societies publish their journals.
While it is not at all obvious how AGU should. larity Structures, 1982-1983, 49 publications, 12 published by AGU. Gurrent adivides in clude: global definition of londspheric fire

FUN RUN

gor irregularity distributions and causal

na interactions and simulation of high-lati-

nde phenomena; chemical release experi-

apagion processes and simulations of re-

note solar-terrestrial phenomena including

nent for raidies of fundamental plasma

ma experiment for measurement of low-

de-borne imaging radar (SIR-B).

Solar-Planetary

Cosmic Rays

Leonard F. Burlago

since 1966; 45 years old.

Physicist B.S., Universi-

M.S. University of Min-

University of Minnesota,

y of Chicago, 1960;

nesota, 1962; Ph.D.,

1966. Employed at NASA/Goddard Space

Center since 1966, ini-

A member of AGU

earth-orbit irregularities and chemical-injec-

ton phenomena: principal investigator on

Relationships: Secretary-

tially as a National Academy of Sciences/Na-

sional Research Council Postdoctoral Resident

Research Associate (1966-1968). Visiting Sci-

Colorado and at the Laboratorio Plasma Spa-

no in Italy. Research interests include cosmic

rays, interplanetary magnetic fields and plas-

mas, magnetohydrodynamics, interaction of

the solar wind with planets and cornets, and

magnetospheric physics. Co-investigator on

tereral satellite experiments, including ex-

periments on Voyager 1 and 2, Helios 1 and 2, and Explorers 34, 41 and 43. OPEN Depu-

ty Project Scientist. Author of more than 85

scientific papers. Recipient, NASA Exception-

al Scientific Achievement Medal, 1979. Com-

mittee memberships include Solar and He-

liospheric Physics Management Operations

Working Group: Interplanetary Physics Working Group: Contet Science Working

Groups and Working Groups for OPEN.

Flama Turbulence Explorer, Solar Carona

Explorer, and the Solar Cycle and Dynamics

Mission Chairman, Division IV (Solar Winsl

and Interplanetary Magnetic Fields of the In-ternational Association of Geomagnetism and

merican Physical Society, and International

deronomy (1979-1983). Member, AGU.

PhD (1977) in physics, University of Chica-

yo. Spent a year as a resenrel assuelate at the University of Chicago before going to the

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Bouglas C. Hamilton

since 1975; 35 years old.

Currendy a Senior Re-

warch Associate in the

Space Physics Group, Department of Physics

and Auronouny, Univer-ity of Maryland, B.A.,

liversity of Kansas

1969; M.S. (1971) and

this term.

torite to:

844-8849

Amember of AGU

entist at die High Altitude Observatory in

NASA study of ionospheric effects on Shint-

nims; energetic-electron-heam experiments for fundamental studies of beam-plas-

RUNNERS: Enter the FUN RUN (unoticial activity during the fall AGU Meeting)

WHERE: Around Angel Island In San Francisco Bay WHEN: 1:00 pm, Sunday, Decem-

ber 4, 1983 DISTANCE: 5 miles, moderale lerrain

DETAILS: Conloct Richard J. Blokely 345 Middlefield Rd Menia Park, CA 94025 (415-323-8111, ext. 4243)

ing has become inconveniendy large for the presently used l'acilities. In the near term ! favor the organization of more topical confe ences and the continued use of poster sersions. Some of the strain on the West Coart meeting can also be relieved by encouraging more attendance at the Spring Meeting. In the long term, if growth rontinues, it may be necessary to (a) use a larger meeting facility in San Francisco, (b) schedule the various retions of the Union to meet in sequence over a two week period, or (el move to another dis. At present I prefer a, b, and e in that order, but will wish to hear the recommendations of

the Meetings Committee on this matter. "As the leading professional society in the field of Solar-Planetary Relationships, AGU should take the lead in making the public and various branches of government awared the needs, the significance, and die opportunities in our discipline. I believe such actions are a proper activity for AGU. However, I strongly oppose suggestions that AGU take stands on political issues which do not have a direct hearing on the primary goals of AGU."

Solar-Planetary Relationships: Secretary-Aeronomy

Gulumabas G. Sivice A member of AGU since 1972; 45 years old. Professor of Physics and Head of Physics Derartment, University of Alaska, Fairbanks, Major interests: Atomie and undrenlar pracesses in the atmosphere; magnetosphere-lonosphere interaction, B.Sc. in Physics, University of Louthon, 1963; 19.D. in Physics, Johns Hop kins University, 1070. Post-Doctoral Fello Institute of Spare and Atmospheric Studies, University of Saskatchewan, 1971-1972; Geo physical Institute, University of Alaska since 1972; Hearl, Graduate Program in Space Physics and Atmuspheric Science, 1980-1982; Program Director for Aeronomy, NSF 1982-1983; 35 refereed publications, 17 pul lished by AGU. British Petrolenm Academic Achievement Award, 1962, 1983; British Communwealth Fellowship, 1965; Rockefeller Foundation Fellowship, 1966-1970.

physics, geoplasma instabilities, ionospheric tregularity distributions, active experiment in space, laboratory simulations of space plat ma processes. B.S. in Physics, St. Joseph's.
University 1982 Dt. D. & Experimental Plas University 1983, Ph.D. in Experimental Plasma Physics, St. Louls University 1969. Alexander von Humboldt Scientist, Physikalisches Insdut, Universitaet Wherzburg, German, 1969-1970; NRG Research Associate, NASA GSFG, 1970-1972; Research Physicist, NRL Aeronomy Section, 1972-1975; Head NRL Aeronomy Section, 1975-1981; Visiting Sci entist, UGLA, Experimental Plasma Physics Group, 1981; Head, NRL Space Plasma Diagnostics Group, 1981-present. Memberships! URS1 Commission III WG 5 (1974-1975). IMS Working Group for ICAS (1976); NASA/NSF Steering Committee for Solar-Terrestrial Physics Workshop (1989–1983); co-chalrman NASA/NSF STPW Working Group on High-Latitude lonospheric Irregu-

University of Maryland in 1978. Areas of scientific interest include the origin and acceleration of energetic particles in the magneto-spheres of earth, Jupiter, and Saturn, the composition of solar cosmic rays, the propagation and acceleration of energetic particles in interplanetary space, and instrumentation development for the detection of charged polar wind expansion; principal investigator on the S3-4 satellite investigation of F-region particles in space. Author or coauthor of 18 scientific papers, 7 of which were published in AGU jnurnals, and presenter of 11 talks at on the SD-1 satellite investigation of P-region inegularities; co-investigator on the NASA/
Shoule Beam-Plasma-Physics team, principal investigator on LASSII/CRRES "in situ" plas-AGU meetings. A member of AGU and the American Physical Society.

Mory K. Hudson A

member of AGU since

Solar-Planetary Relationships: Secretary-Magnetospheric Physics

1972: 34 years old. Associate Research Physicist and Senior Fellow. Space Sciences Labora. tory. University of California, Berkeley. Major interesis: space plasma theory, auroral particle acceleration, plasma simulations. B.S. in Physics, UCLA, 1969. Member Associate Staff, The Acrospace Corporation, 1969-1971. M.S. in Physics, UCLA, 1971; Ph.D. in Physics, UCLA, 1974. With Space Sciences Laboratory, University of California, Berkeley since 1974. Member: AGU, APS; Woodrow Wilson Fellow, NDEA IV Fellow, Phi Beta Kappa, Regents Scholar. Served on Committee on Solar and Space Physics, 1976-1979 (NAS-NRG) and presently a member of OPEN Science Working Term (NASA). About 34 publications, 24 published by AGU. Currently Associate Editor, JGR-Space Physics.

George K. Parks A member of AGU since 1964. BA and Ph.D. in physics from the University of California, Berkeley, in 1961 and 1966 respectively. Spent 3 years as a post-doctoral research associate in the School of Physics and Astronomy, University of Minnesota, Minneap dis, and 2 years as l'esseur associé at the Faculté des Sciences, Université ile Tonlonse, Toulonse, France, before he joined the laculty at the University of Washington, Scarde. Currently professor of geophysics and holds adjunct professorships in the Atmospheric Sciences and Physics departments. Research interests include experimental and theoretical studies of space plasma phenomena. Conducted ballon-borne and spaceeraft experiments since 1964 to study auroral, magnetospheric, and inter-planetary space plasma phenomeno. Most re-cent research endeavors include looking for energetic X rays from thunderstorm and

Solar-Planetary Relationships: Secretary-Solar and Interplanetary Physics

lightning active regions.

Alan J. Laxarus A ember of AGU since 1960; 52 years old. Senior Research Scientist and Academic Officer, Physics Department, MIT, S.B., MIT, 1953; Ph.D., Stanford, 1959; RAND Corporation, 1958-1959; MIT, 1959present. NASA Hq., High Energy Astrophysics, 1974-1975; Associate Dean of Students, MIT, 1977-1980. ests: large scale sol

Main research work: construction of instrumentation for measuring the solar wind and analysis of data therefrom. Principal intertion of the solar wind with planetary magnetospheres, and the structure of the magnetospheres themselves.

Bruce T. Tsurutani Member of AGU since 1967; 42 years old. Currently a member of the Technical Staff of the Space Physics Section of the Jet Propulsion Laboratory, Galifornia Institute of Technology. Areas of scientific interest include: interplanetary

physics (heliosphene magnetic field configuration, cosmic ray modulation); collisio shocks, upstream waves, and particle acceleration; solar wind interaction with magneto spheres (magnetic merging, viscous interac-tion); plasma physics (instabilities and waveparticle interactions); magnetospheric plasma waves (plasmasphene hiss, chorus, magneto-pause emissions, lion roars); auroral physics (particle precipitation, substorms and storms); and astrophysics (X ray bursters). B.A. and Ph.D. from the University of Galifornia at Berkeley: Permanent employee of JPL since.

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graduation from 8erkeley in 1972. Also a Hyman Orlin member of AAAS, Sigma Xi, N.Y. Academy of Sciences, and URS1. 72 publications, half Erick O. Schonstedt Athelstan Spilliaus of which have been published in AGU join-A. F. Spilliaus, Ir John W. Townsend, In nals. Publications in other journals include: James A. Van Allen Science, Nature, Scientific American, Astrophys. J Letts. Recent publications include: "Waves Charles A. Whitten Upstream of Interplanetary Shocks" (JGR, in |. Tuzo Wilson prets, 1983), "Energetic Protons Accelerated Individual Supporting Members at Corotating Shocks: Pinneet 10 and 11 Observations From I to 6 AU" (JGR, 87, 7389, Philip A. Abelson, William C. Ackermann. 1982), "Lion Roars and Nonoscillatory Drift Mirror Waves in the Magnetosheath" (JGR, 87, 6060, 1982), "Diffusion Processes in the agnetopause Boundary Layer" [GRL, 9, 1247, 1982), and "Observations of the Interanetary Sector Structore up to Helingraph Latitudes of 16°: Picmeet 11" (JGR, 83, 717, 1978). Current Secretary of SPR: Solar and Interplanetary Physics. As Secretary, has organized or is organizing 10 Special Session of AGU. A member of the AGU Journals Board since 1981. Currently leading the revi sion of the AGU indices and the merging of the indices with the Am. Inst. of Phys. PAC system. Currently a Co-investigator on the

on Collisionless Shocks (Napa Valley, Feb.

SPR Nontechnical

Two nonteclinical events are scheduled for

the Solar-Planetary Relationships (SPRI Section during AGU's 1983 Fall Meeting in San

The Section business meeting will be held

at 5:15 p.m., Wednesday, December 7, in the

Emerald Ball Room of the Holiday Inn. One

of the agenda items for the business meeting

wish to do about business meetings and social

Later that evening, there will be an SPR so-cial hour (cash bar) followed by dinner at A.

Sabella's restaurant on Fisherman's Wharf,

beginning at 6:30 p.m. SPR President Mareia

social occasion, with no speeches, but perhaps

some entertainment (if anyone comes up with

Mista (a green salad with Italian-style goodies in it), shrimp risotto, and either chocolate or

won't eat shrimp, a few entrees of filet of sole will be available. The cost is \$18.50 per per-

son, which includes tax and tip. Some earlier

announcements listed the cost of the dinner

as \$20.00. If you have paid \$20.00, you will

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vidual Supporting Members, there are 16 Life Supporting Members. To have achieved

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they have no further dues obligations.

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Pembroke J. Hart

leimut E. Landsberg

Murli H. Manglinaoi

A. Ivan Johnson

Paolo Lanzano

L. L. Netileton

this special recognition, they have contributed

any good ideas). The menu will be Insalata

mint parfait. For those of you who can't or

bauer reports that this will be a purely

is to determine what the section members

Sessions

events in the future.

get a \$1.50 refund.

Supporting

Members

IndividualB

Kejiri Aki, Frauk C. Ames, Richard J. Anderle, Kinsey A. Anderson, Ralph B. Baldwin, Celso S. Barrientos, Joseph W. Berg. Ruscoe R. Braham, Jr., Marx Brook, Lloyd E. Brotzman, James D. Burke, Joseph C. Cain, Frank B. Campbell, Bernard H. Chovitz, Charles C. Cumselman 111, Woody L. Cowan, Albert P. Crary, William D. Crozier, Charles L. Drake, Earl G. Droessler, Peter S. Eagleson, Gordon P. Eaton, F. R. Engdald, Albert G. Fiedler, Robert S. Fino, Trene K. Fischer, Robert D. Fleicher, Herbert Fried-- John J. Gallagher, Jr., J. Freeman Gilbert, William C. Granstein, Thomas I. Gray, Jr., ISEE-3 and ISPAI Magnetic Field Investiga-Edwin T. Green, Richard Groeber, John K. tions, MS-T5 Plasma Wave Investigation and Hall, Sigmund I. Hammer, John W. Handin, the EXOS-D Ultravider Experiment. Co-or-Warren W. Hastings, Hugh C. Heard, J. B. ganized an ISEE Upstream Wave and Particle Workshop and a special issue of JGR (86, Hersey, Kenneth L. Hunkins, David S. Johnson, Albert W. Kaddatz, William W. Kellogg, 4319, 1981). Presently participating in the organization of an AGU Chapman Conference Carl Kisslinger, John A. Kuanss, M.c. A. Kohler, Serge A. Korff, Dale C. Kranse, Ir-

> Lill, J. Virginia Lincoln, James P. Lodge, Jr. Alexander Malahoft, Thomas F. Malone Elwood Maple, William Markowitz, Ronald G. Mason, John C. Maxwell, Vincent E. McKelvey, Gilbert D. Meatl, Javlee M. Meatl, Buford K. Meade, Leslie H. Meredith, J. Murray Mitchell, Jr., Christopher N. K. Mooers, Jerome Namias, Worth U. Nowlin, Jr., Amos Nur, Hugh Odishaw, Feodor Osiapoli, Ned A. Ostenso, Ernest J. Parkin, O. Scon Petty. '. H. Pickering, Louis O. Quam, John C. Reed, Joseph L. Reid, Malcolm Rigby, Walter O. Roberts, Eugene G. Robertson, Juan G. Roederer, Claes G. H. Rooth, Morion J. Ru-

ving P. Krick, Joseph W. Lang, Gordon C.

bin, William B. F. Ryan.

Michael Schulz, Alan H. Shapley, Joseph V.

Smith, Waldo E. Smith, Kenneth G. Spengler. Thomas W. Siern, Edward G. Stone, Glenn E. Stont, Verne E. Suomi, George H. Sutton, Kendall L. Svendsen, Lynn R. Sykes, Manik Talwani, Charles V. Theis, George A. Thompson, M. Nafi Toksöz, Richard P. Turco, John W. Vanderwilt, Pierre Verdeil, lames I. Vette, Glyde Wahrhaftig, Martin Walt, Harvey O. Westby, Fred D. White, Loren D. Wicks, Owen W. Williams, Abel Wolman, Oliver R. Wulf, Gordon A. Young, John M. Zeigler.

Organizations

Many organizations show their support of the objectives of AGU through supporting membership in one of the following dues categories (1984 rates):

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AQU (cont. on p. 940)

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Western Geophysical Company

Membership Applications Received

Applications for memberolip have been received from the following individuals. The letter after the traine denotes the proposed primary occion affiliation.

Motowo Fujiwara (A), B. A. Hausman (SM), N. Ross Hill (S), Donald O. Hodgino (O), Ronald V. James (H), Jeffrey Paul Laible

(H), Barney D. Lewis (H), Randall Marrett (T), Paul Januez Martin (O), Peter R. Marvin (T), Dai C. McClurg (P), R. C. Michael (T), David B. Naslı (H), Marcy S. Newton (V), Kazylino Ozawa (V), Nakaya Shyii.

John E. Heidenreich (A), Diane Heinze (H), Jean Housepian (A), Hans W. Januacch (O), Lee Scott Kelley (T), James Knapp (V), Scott Linneman (V), Authory R. Lotiner (H), Andreo J. Mentlez (S), Gregory Murphy (V), Dapei Wang (H).

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Aeronomy

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P. K. Bartle (Systems and Applied Sciences, 5808 Annapolis Od., Selia 680, Hysitaville, Rd, 50380 A. J. Fleig, K. F. Klask, C. K. Kong, D. Gordon

Total ozona measurements made by the SBUV and TOMS isulframeolic on the Nicobus 7 spacesail are compared although the second of the SBUV and Tome Second on the Nicobus 7 spacesail are compared although the second of the SBUV and TOMS isulframeolic on the Nicobus 7 spacesail are compared although the SBUV and TOMS are selected and the SBUV and TOMS are altered than Dobson and B.1% annalize than NSS1 corresponding SBUV blases are 3.3% and 11.1% respectively. Meson selected the SBUV of TOMS are irruster clanded reveals an appareal bias between the Dobson and NS2 salvorsho of 3.0% or 2.5% respectively. Meson selected the selection of the blas between the spaces and ground measurements is altered to a contribution in the store absorption on affoliate to use of in processing the measurements. Precipion of lotal ozone relatived from alther the SBUV or the TOMS instrument is absonable to be delicin. Precipion of a typical Dobson measurement is estimated to be 1% which is comparable to that of u wall run Dobson claims and all about 2% and that of an MS3 measurement is estimated to be 4%. Apparent should be in excellent agreement with the ground observe flors. An instrumental derift is found in the SBUY! TOMS to the measurement with the grand of the selection of the SBUY! TOMS to the measurement of the selection of the spaces and the selection of the selection of the spaces and the selection of the selection of the spaces and the selection of the selection of the spaces and the selection of t

Geophys. Ree., Atmos., Paper 301668

0490 Ganeral (YHF-Reder) THE MOBILE SOUSY DOPPLER RADAR - LECHNICAL DESIGN AND FIRST RESULTS FIRST RESULTS

P. Crechously (May-Planek-Institut für Aeronosio, 3451 Katleaburg-lindau, FRS) G. Schmidt oed R. Rüster Beaad on the caperiance obisied with the sixt Loory SOUSY reader in the Herc mountains, a mobile WHY Dopplor system was developed during the last two years. The electrosic part is installed in a 20 ft container and was tested for ise first time dering a joint experiment at the Araribo Observatory (Puerlo Rico) using a special log-periode aeriol to illuminete the 300 e dish. Is 1982 this system was extended by designing a mobile phased entenna error with 576 Teg clements. The groupleg of the single yagle, the founding metaort, the phase with 167 the power splitters und the TR-sultch are Genribed. A gamery of result obtained during the first two campaigns is presented at mell as a survey of futers program deconstructing the flaulbility of this roller, page 131716

Red. Sct., Paper 381714

Electromagnetics

O'NY ARCENTAGE

RADIATION OF LCT ACQUETEC MAYEE FROM A BOLLO OPHEFICAL

FFORE IN A MARE ISOTFOPEC PLASSA

H. Bailegas I Centre de Repherchec en Physique de

J'Environnemant Terrestre el Planstaire, 94 107

Baint-Maur, Francel

Saint-Maur, France!

The hatariour of a wild sphericat probe increased in o ware factropic reliableniese places, bleed to piezza potentiei, and oxeited from an alieraring rurrent source, is investigated for frequenties below the los piezza frequency. A hydrodynamic description of the planum is used, tagether with absorptive boundary conditions for the aiserrous and ions at the probe surface. Expressions are derired for the etcernating potential in the planum, as a function of frequency, of realist distance, of probe reduce and of the planum pares stars. Buth of this potential is due to its aroundir watch, the applicate of which depends attempting on the ratio Rp of the gaths radius for the strongly on the ratio R_p of the gamba radius to the Debye iangth. As acco as R_p success the ratio Fifty of the each radius and in the radius of the earlisticm frequency to the electron plusser frequency, the amplitude is reduced that being its value for R_p = 0 corresponding to a point source, it is shown in particular that, under some conditions, for vature of P_p over a certain loised resput this reduction is independent of R_p. The scaller har ratio of the accitation frequency in the long plasma frequency the larger is this range. (Antennes, placess, ion accountly waves, mallulical). Red. 9ci., Paper 351607

SY73 Remote sensing RETAINED AND COMPOSITION FROM PLANES 7 RETRIEVAL OF TEMPERATUROS AND CONTROL PHYSICS, Clerendon EARS MONGERS (Dept. of Atmospheris Physics, Clerendon Laboretory, Oxford OX3 Jpd, Oceat Stitale), N. L. Jones

and J. J. Barnott

A general purpose stochasts sequential estimator to
described, which siless the inverse grobius of remote
sounding to be solved in an optimum sanuse. The are
of a caquential satisator allows southwatty is the
hertmetal or in time to be included, making the
seption; as timeta close to the final solution, an thei
starstion is not required. The scan pattern in which
aspurseents are made in not oned and oved not be known,
an that the problem of speciarist extinuic stability in
minimized. The method gives both a solution profile
and its arene covariance. It is applied to both temparature and composition sounding from a limb sounciby
lestrement, the first or Findus 7, (options action to
jon, temperature, constituents).

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6773 Parote Sampley THE EASTH RADISTION BURGET DERIVED YEAR THE Herhert Jecobowitz (BOAA/Wational Environ-

nental Satellita OSCA and internation Service Mashington, O.T., 20211, Sichard J. Tiche, and the Cinbus-7 SER Experiment Team The Earth radiation budget as determined from the 840 experiment abourd the Minbon iting sutellice is prese form of time-istitude cross-sections, hears pherically and globally averaged time-plots and annual global averages for the time per ind spanning November 1978 through October 1979. Comparisons are needs between results derired from the fixed wide tield-ol-view (MYOV) radiometers and theme derived from the scenning serrow fleld-pl-view (MFC) While there is exemilent some ment in repard to the special and tem The MFOV yfelds outgoing longwave thus albedos that are respectively about 40% and 2.5% greater than these derived ince the MFOV sensors. Also, limited state transcreament with the sensors that the sensors that the sensors that the sensors that the sensors the sensors that the senso

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0700 Scottering REFLECTION AND SCATTER PORMULA FOR ANISOTROLICALLY TURBULBNY AVR REPLECTION AND SCATTER PORGULA FOR ANISOTROLICALLY
TURBULBNY AIR
S. J. DOVIAK [National Severe Storms Laboratory,
1113 Selisy Circle, Norman, OK, 73089) D. S. Simic'
Extating Normalizions assume that the correlation
length of refrectire index frequiertties, generated by
turbulence, are mail compared to the Fresnel Langth.
Sut there is experimental suddence that the cancerary may
be case. This paper extende the existing loroulations
lar the case where the Fresnel soon radius is comparable
to or emailer them the actrolation length and develops
a station-ical solution that ambraces asveral etholog
uschanisms. Conditions as speafifed under which
Fraumhofar and Fresnel reflection used scaling from turbulent air can be distinguished. An integral expecsation
lor sche power is developed which shows they sabe
latemality depeads ont only on a resolution volume
weighting function, but also on a more important Francel
term. The spectral sampling function demonstrates the t,
for resolution volumes in the entenme's lat field, this
function is independent of the location of the caselution volume. The conditions under which etho power is
proportional to the square of pelus width is beard upon
the staticatical approach barein adopted for Freenel
scattering.
Red. Sef., Feper 181706

Exploration Geophysics

Rad. Ser., Paper 381706

0910 Computer Applications
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See 0930 Saireic methods
Thisery Bourble [Vormerly Capt. of Geophysics, Stanford
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at 4 Avs. de Sois-fram, Swell Helmaison, Francei
Alfonso Commaiss-Sarrado

oniversity; presently institut versues is do fetreis, is at 6 Ave. As Bois-feezu. Suell Kalmaison. Francai Alfonso Gonzelez-Serrezo.

Synthatic selsograms are computed in a roo-dimensional medium that contains contrasts buth in the sissic sed is the attenuation (QI properties with depth. The case of a iquid-notid interlate, with and without a Q routrest between the ten media, is examined in detail. We show the Taucits when the S velocity in the liquid. The solid is greater than the P velocity in the liquid. The synthatic selmograms show that the effect of the extessuation contrast is not noticeable on precritical reflections when rise change in election properties is large swen in the case of large Q contrast. When fill eliquid oi the postcriffical reflections and decrease in amplitude oi the head wave. It is interesting to meline that when two head waves are securated, the P were always has a very low smplitude with respect to the S head wave. This result agrees with what hac been observed in horehold Sats. We slow with and without Q contrast. The synthatic selemogram with and without Q contrast. The synthatic selemogram shows the same type of results as in the previous cesse but less pronoenced due fo the smaller portion of the total path occurring in attenuating selfus. It also chows that the converced veves is - P and P - S) are of opposite polarities and so merty cancel each other.

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0930 Zeismic sethode CORNEST TO "OFFESELEATION OF IN SETU ATTENTUA-2108 FEOM PULL WAVEFORN ACOUSTIC LOCE" BY CH. S. CHORO, N. P. TORROZ ASO M. S. WILLIE L. Zogelherd [Instirut, fOr Coophyelk und Settorologie, Technische Volvereität, 0-300 Steunachvelg, y. S. Geranny), Th. Cros and P. Sau-

Chang at el. hass published preses spectra es determined from full wavecreis enatyels of an asoustic logging record. A relerstpression of cheen spectra according to the homotral retip. merhod isade to a Q-valos oy sCont' 18 is contradication to rheir originat systuation of 95. A discussion for the reason of this discrepant ry is given, The accuracy of the datagether lonof Q in gamerat to also discussed. Gamphyn, Man, Egyth, Vapot Juigle.

Geodesy and Gravity

1910 Createl Hovementa BORIZONTAL STRAIR ADBOOS THE VARATCH FORMI SEAR SALT LAIR CITT, UTAS R. A. SHAI (Mathonsi Geodetle Durvey, Charting and Doodetle Services, Netional Ocean Servine, MOAA, Nockville, Md. 20852), O. B. Smith and T. Soler

Decelation Services, National Geam Service, Road, Nockrille, Md. 20552), D. S. Saith and T. Solar Two discent gascatic emiser's epos a 18-ks sectod of the Vesatch fault ecos in sorth-central Vish. One of the cetworks, isocated to the vicinity of Duit Lake City, was observed by the Mational Ocean Service/Outlocal Geodatic Survey (MCS-9003) to 182-1953 (triangulation acceleration of the Service of the entworks, isocated to the vicinity of Duit Lake City, was observed by the Mational Ocean Service/Outlocal Geodatic Survey (MCS-9003) to 182-1953 (triangulation ocean). To the sorth, ic the vicinity of Educ. the Ocean Colonial Survey (MCS-9003) to 182-1953 (triangulation ocean). To the sorth, ic the vicinity of Educ. the Ocean Colonial Survey (MCS-9003) to 182-1953 (triangulation ocean). To the sorth, ic the vicinity of Education Surveys of the second ontwork Curing the 1972-1981 interval. When fit to a model examine both temporal and spatial benegately for the strain rata, the two independent dais ease yield sutently consistent strain rata isnaora. Butheta of the 380/HOO deta, however, suggest epatial variation is the shrain field, and a subset of the Ocean Cata indicate a possible is such that we are accordated underlying afformational patient characteristed by eact-augit (E-W) maximus pricoipal siral feats as an august an underlying afformational patient from ragional est suicity and Quatarnary geology. The suspected variations would imply that the area to the north of Sail Leka City superismed significant 3-V compracsion praceding 1978, in contradiction to the madriying strain pattern. This compression may be caused by the sountainous block, seafward adjancet to comprace of m S-N traceling anto of unablane, for example, escodery feate, loosted sorth of Sail Lake City to axplain how the stress fluid to the narth mag be decoupled from that in the south where 2-V compression pate of the suspacial derictions is the south where 2-V compression the information ocetribute scene plant by the companion has not bean datect

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O. T. Sandwall (Mational Geodatic Survey, Charling
and Geodello Servines, Mational Geome Servine, MDAA,
Rodwitle, Md. 20652)

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For leximos, frecture soons (FZ'o) appare as alongated
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Hydrology

and the state of the state of the partial of the state of toth expressions are highly variable in sinhie channels. Constancy of the Einstein and Bhiede expressions provides, to fact, a sufficient but unseessary condition for channel stability. In saxinus friction factor bypothesis there is co saxinus for fidinal factor who channel with, dand stops are dependent veriables. Variational principles may one day supply a solution to the problem of alluvial channel stability but surrent formulations of the continued hypotheses require redefinition (stable channel design). Water Resour. Ras., Yaper Wy0047 Water Resour, Res., Yapar 391047

JIES Glarfology
JAKOS CHAMS GLACIER DRAIMAGE BASINI A SALAMOE
ASSESSMENT
R. A. Olndackadian (Code Q12, HASA/Soddard Space
Flight Center, Greenbelt, NO 2071)
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If A finitus aleasent simulator to approximate the transport velocity listed to a porous medium should be been upon the transport velocity representation of the Barry and continuity aquations. The transport velocity representation to the conventional pleasant representation to the conventional pleasant representation asserting in the cleant code bias on the presents representation of the Upon the continuity equation on the standard that continuity equation on the standard relatively and the continuity equation on the transport code biased on the transport velocity representation of the transport velocity representation. [Groundwitzer, water quality].

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CORRELATED flow PECFORS
J. R. Oledinger (U.S. Geological Survey, 410 Retland
Center, Oeston, Virgiole, 22092) and R. N. Nogal
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tless of disaggregation models is presented which
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3189 Waier Quality [Stram charlety]

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1199 General (Mater Usof CASCADS NODEL OF NORTHLY MANICIPAL UATER THE David B. Raidanet (Department of Civil Engineering, Malvorsity of Texas, Austle, Texas, [8][2], Cassal

A time series model of menthly mentalpal water of a time series model of menthly mentalpal water of a formulated on a sat of equations representing the affacts of four fanter on water user trans.

sessensity, sutcontrelation, and classic corrulation. The parameters of these equations or found by pecific the water one time series prompt a seacade of four transformational is each a osacade of four trensformations; le saintensaformation the parameters of an equation smeciated with one furtor era districtly determined and the series trensformed to remove the effects of chie fontor. After the lest trensformation only a random error earlier tension, trensformation only a random error earlier tension, the series of the series of the series of this error is captured to the series, evided among the four factor es trensformation of this error estread (27), and supported the four factors estread (27), and supported the four factors at random error is climating correlation (112), the random error is about to be normally distributed by a sociative. parametric procedure charactering probabilit; families by their densky questile functions. Vater Resour. Resc. Paper 3x1712

Meteorology

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rango of 6.7-10⁷ m/s to 17-10⁷ m/s) the mean three-dimensional propagation speed found for 32 dary inadors is 20-10⁶ m/s with a range of 9.5-10⁶ m/s in mean deri iongth measured is 50 m with a range of 15 m to 30 m. In two of the teres listher, the downward propagating derr loaders appoor rommor upward propagating arranmers at Reights of approximation; 20 m and 30 m, respectively. (Lightning)

J. Goophys. Res., Attos., Paper 3P1755 1735 lElectrical photomens)
CHARACTERISTICS OF LICETHING VHF RADIATION HEAR THE
TIME OF EXTERN STROKES
C. O. Hayong Licenthylical Research Coucar, Physics
Department, New Maxico Institute ol Sining and
Technology, Sonarro, New Maxico, 878011

Veing a crossed baseline interferometer, lightning WHF source positions correlated in lies with electric lield change measurements here bere obtained. We present data in this paper shaving sefecth ead elevation pictures with high time resolution of the WHF 134.3 His radiation for evants near the fine of returns troken. From their common characteristics selectes established the sevent settlement of the world for the second characteristics selected. No rediction was seen that could be attributed to the neutron second. cases. No rediction was east that could be attributed to the raturn stroke wasefroot lessi. Radiction from erapped leaders continued up to end, in case cases, after initiation of the lirat ceture stroke. A strong burst of radiction other lollowed the lirat return stroke. Strong tediction began below a subsequent return strokes, toleriding with the slettif field thange usually associated with the dark teador. The end of the rediction was independent of the return stroke. The source of this radiction was a well-delined region within the cloud. A second burst otten followed the return stroke functed in the same region as that pilot to the stroke. Source from region as that prior to the stroke, Sources from etroke to stroke showed bectabotal displacement with little apparent change in elevation. |Lightning.

J. Grophya. Sen., Almos., Paper 30171d

3730 Electrical Phonomena REGUCTION OF THUNDEDSTOOM ELECTRIC PIOLO INTENSITY PRODUCEU BY CODONA FROM A NEARBY

OBJECT
S. Yonnagul, Almosphoric Sciences Research
Caniar, Siele University of New Tork at Albang,
Albang, Naw York 12222
Measuremanie with an olectric field mill
becauth a thunderciewd show that space charge
produced by cerons from a surrounding, herisoctal, fine-wire anranne rhat is connected to the
carth gracity raduces the alsotric field infamelty.
J. Gaophys. Res., Armes., Paper 301690

3749 General citcalation
Observations Of CH. AND N.S. BY THE SORDS 7 BAHS: A
COMPARISON WITH IN SITU DATA AND THE STRUCTURAL
NAMERICAL MODEL CALCULATIONS
J. A. Pylo (SEEC/Purborford Applaton Laboratory,
Chileon, Drdcot, Oxon Oxil Oxx, DWITED KINDDOM),

J. A. Pylo (sectification Appleton isobratory). Chileon, Diffect, Coan OXII OXX, DRITER KINDOXI), R. 1. Jones
Honthly easn, zonel does measurements of CS, and
N;O (or 1779 made by the steatospharle and manospharle
mounder (SAMS) on the Nimbus 7 satellite are presented
for the first tree. Comparison with is struend other
evallable data confirms a general pittern of alking
tatice decreasing with height and of markes, at a given
pressure level, In for imitteds. The SAMS data, by
virtue of its extensive coverage, revests new features.
Those include during certain months a 'doubte posk'
when, slong a constant pressure surface, mixing ratio
making are found in low fattudes of both hemisphares
with a local minimum at the equator. In the upper
stratosphere are found regions of weak sed errong herrenter gradients. Comparison with a two dimensional
model shows many areas of agreement, sepacially for
CM., and the model is used to interpret atmospheric
behaviour. The model oversettantes in terms of a possible undercetimation of the photocheadcel sink. We
hellows errongig, however, that uncertainties in transport representation cannot be rubed out.
J. Roophys, Kas., Atmos., Paper 30164A

J. Roophys. Ros., Armos., Paper 30164A

3790 Tachniques (Precipitation Messurement) A REVIEW OF MULTIPARAMETER RADAR OBSESVATIONS OF A REVIEW OF NULTIPARAMETER RALAR OBSERVATIONS OF PRECIPITATION

R.R. Rogers (Moreorology Supertment, McCrif University. Memorasi, Canada, Mia 280)

This paper ravious the satiods that have been used in the field of rader neceorology to obtain Information about precipitation by occurring quantities in addition to the rader reflectivity. Its purpose is to set the stage for papers on current research presented at the stage for papers on current research presented at the UESI Symposium on Multiple-Persuater Radar Sozeuraments, Mid in Sourpessucch, UK, in August 1902, by outlaining outtier derelogments and problems. Exphasis is placed on differential reflectivity nessuroments by dust polacisotion or duci wareisangth mathadel, Doppler seasurements, sed depointination ansurements, the techniques figuring prominently to the papers of the Symposium.

Pad. Stl., Paper 180890

Mineralogy, Petrology, and Crystal Chemistry

OXYGEN SELF OFFUSION IN QUARTS USES EINDEVENDEND PRUI P. Dennis | Department of Geology, Imperial COLLEGE, LORIGON SWY 18F, O.N.I. Copyen self diffusion, Day, has been monitored in single crystal quarto to the tampereture range \$13-\$50°C under hydrothermal conditions. In the beta field, between 700-850°C, the dace are represented by two linear Archeedus relations for transport parallel and perpendicules to 9 о in²e⁻¹) Де(ка ап1⁻¹)

10 1 2.09 u 10-1t 1t8.54 1(1010) : 5,15 m te-10 203,72

At 700°E, to the total pressure range tt.5-100 MPs, Now is independent of water and oxygen fugnities between the Mi-NiO and Pajog-Pejoj buffers. The results are consistent with diffusion via a simple charged watercy mediants under an attrinate point defeat cy mechantan under an astrinato poi the sature of the mobils oxygen defeat.

It we aspect of the sesuits is the observation that
at the low water fugacities of the present experiments
a hydrogen containing defect appears to play as rois
is the oxygen transport suchanias. This is is contrast
to other published such of dels and leads directly to
the requirement for destriked interlaboratory
comparisons. (Diffusion, point defeats, quartel, J. Gasphya. Res., Larth, Yupor 301510

Oceanography

A799 General (Mind-driven turrenta)
A THEORETICAL PESPONSE OF A WING-DOLVEN OCEANIC SUR-FACE LAYER AND 175 APPLICATION TO THE ANALYSIS OF LAGRANGIAN HEASUREMENTS
J.K. Tenic(Science Applications, Inc., 4148 Carter Creek Partnay, Bryan, Javas, 77802) and M.W. Domoer An ensylviciol response of an oceanic turlace layer to wind sireas is given for those silvations in which horizontal preture seed stress available or manifested. which stress is given for inose situations in which horitomial pretture end et eas gradients are neglected, the vertically averaged velocity 0 of the aurieto leyer is teen to be the two of ting-dampool certiel certification; for the what threes 7, that is relatively constant, the ensighted solution reducet to 0 = Ar., with

both the Cortolis and boltom frietion errects included in the mairix A. An empirical analysis method is presented which compares the theoretical treasports based or wind data with artual volocities as detarmined by legrangies observed ones. This method cas be used to determine the effect of bottom trietion, the depth of the wied-drives turface layor, and the time-integrated offset of boritontal pressure ded stress gradients. An example is presented asing wind and position date colvected an the Articl fre pack dering the summer of 1915. (Surlate rurrents, wied forcing, Lagrengian measurements, les motion).

J. Reophys. Fea., Occass, Paper 101718

Journal of Geophysical Research

Yolumo BB Number A11 November 1, 1983

Voyager Mission to Saturn Color Plates
The Voyager Mission: Encountry With Saturn 1Paper 34 1209 Voyager Photopolarimater Stellar Occultation of Saturn's Rings | Papet 3C09111 | L. W. Espotato, M. O'Callinghan, K. E. Simmons, C. W. Hord, R. A. West, A. L. Laute, R. B. Pumphiney, D. L. Cuffeen, and M. Saht Voyager 2 Observations of Saturn's Northern Mid-Latituda Cloud Fraueros, Morphology, Motions, and Evolution | Paper 3A10361 Evolution (Paper 3A1038)

L. A. Stomoveky, H. E. Revertomb, R. J. Krituva, and V. E. Smont.

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Low-Energy Plasma Ion Observations in Saturn's Magnetosphere (Paper 3A1254).

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ionopause | Paper 3A08301 | H. Percz-de-Tejada, M. Dryer, D. S. Intriligator, C. T. Rutsell, and L. If. Brace Nitrogen Eccepe from Mars | Paper 3A12041 Solar Modulation of Calactic Cosmic Rays 5, Time-Dependent Modulation | 1Paper 3A (3)(1) J. S. Perko and L. A. Fh.

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Calculated and Observed Limb Profiles of Ol. (1356-Å) Dayglow. Paper 3A 1206.

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Distribution of MRD Wave Activity in the Poreshock Region and Propenties of Backstreaming

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وأطريق

5320 Cosmic ray eltects (Lunar rocket COSHIC RAY EXPOSURE HISTORIES OF APOLLO 14, APOLLO 15, AND APOLLO 16 ROCES now newton to ROLES

8. tugetor (Shysikellaches Institut, University of
Sorn, 1017 Sern, Switzerland), P. Eberbergt, J. Gales,
N. Grdglet, M. Jungch, S. Heler, M. Hürgeli, and S.
Niederes

prer
investigate the exposure history of six lunar rocks We invostigate the exposure history of air lunar rocks using. The abundances of complerary produced notic gas leatopes and the "EXT-Kr age. Single-stage exposure histories are interred for baselt 14053, braccis 14365, and anorthorite 88315, as prepose right baselt 16053 with a "Ext-Kr age of 21.225,0 m.r. is a Come Crater ejecte and that aporthesite 65315 (1.310.1 m.y.) originals: from South Sav Frater, We present a comprehensive comparison of all commogenic notic gas ratios and abundances for rocks with alogis-stage exposure and show that the agreement with values predicted by nutlest syntematics and jargor of semant chapters are not in prothat the agreement with values predicted by nucleat sys-teomics and sarger element chosistry is good, in par-ticular for isotope ratios. Samelt 18310 experienced a sulti-stage exposure. The apparent history age, the depth sensitive isocopic ratios and limino 136%, mainly from 2350 (nduced by secondary cosmic-ray neu-tions, isnd to the conclusion that this sample was pra-esposed 1.75 AE ago to cosmic tays for a dustion of 330 m.y. Samalt 1308s and amorthosite 154th size raves jutti-stage exposures. The shorders of the radiosumide multi-stage exposures. The spendance of the radionuclide six in 19098 increases toward the surface of the vech reliecting an enhanced production rate due to solar liste particles, whereon stable ⁶³St concentrations are constant with increasing depth wittin the roch. This includes that headr 18018 received most of its (rendlation in a mose shealed lication than that effective during the last million pages. J. Geophys. Res., Fatth. Page 785001

Particles and Fields— Ionosphere

SRIS Autoras

RREDECTAIN BY MINTON TIELDS FOR PROTEST SURGRAS IN AN by ATMONPHERE

E. Van By! (Physics Department, University of Denver, Douver, Colorado, Sétod], M. V. Gesig, and S. Massenn, Absolute photon yields be bard colsions of the Notice traction, and the production of P. decond-positive systems are predicted for protest autorae in an Ng alsosphere. The predictions are rade using a proton-autoral model based largely on collision cross section information, including the production of those calesions in the atmosphere by secondary distance, are sized for the total secondary clockers, production during proton surgrass are also determined. The results are compared with other predictions and with a limited number of proton-autorae autorae observations, [Photon Tields, proton surcress]. J. Goophys. Pos., Space, Paper 141683

5510 eigh Letitude Londspheric Currents RP DESINOZNOS OF ANSORAL ZONS LIELD-ALIGNZD CUSSENT

IF DEFINITION OF ANSORAL FORS LIELD-ALIGNED CUSSENT INTENSITY

F. M. Robinson (SRI international, Radio Physics Laboratory, Henio Fash, Cattornia, 9-0231

Nore than 200 hours of Chatania radar elevation scan date have been used to show that the Pederson current in the tomosphere is limited to a value that is proportional to the planniart magnetic index Pp. By assuming a simple model for the closure of timid-aligned currents in the ionosphere, we argue that this limit is equal to the latitudinally integrated lield-aligned current intensity. A leasi-squares lit to the data gives the limiting current intensity, Jo, by the following expression: Jo (Alba) = 97 · 11 · Fp. ca an extension of this result we use a praviously derived relation estimate results can be used to put an upper little on the Joule houting rais for a law upper little on the Joule houting rais for a given polar car potential drop. If add-aligned currents, electric bields, conductivity.

J. Geophys. Res., Spoce, Pager 341702

5535 Interactions between waves and paritolve
A REARCH POS THE PLASHA PROCESSES SESSITIVED WITE
PERFEMBLICULAR HOM MEATING.
7. M. Eintern (Sabool of Electrical Engineering,
Coresse Oniversity, Ithson, Few York, 148351, David J.

The 53-3 data and has been examined for examples of perpendicular ion acceleration with simultaneous brondback Plessa away data. One awant was found. Massa aswas to the frequency range for lonar hybrid waves and to the trequency range for lonar hybrid or ion excloiron saves accessly correlated with the perpendicular ion acceleration although their sleaking falst expliteds awar less though their sleaking falst explited awar less though their sleaking falst for the LEM requestey very briefly revented a value of 30 st/s (MMS), hal during mont of the event their suplitude ass belon is st/s 1845). May define ass found for the eviatemen of 2 cyclotron waven during the pariod of perpendicular ion acceleration. The thereal or superthereal Es - 176 eV alectron issid-aligned correct density, eatiented by subtracting the current density secured by the slacing openioneatar from that accelerate by the slacing openioneatar from that accelerate by the segustometer, correlated very sail sith the period of perpendicular ion neceivarion. Benaver, the drift vaicetty was too small to axelle lastabilities ionally.

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. Geophya, Res., Space, taper 3A1709

STAGE TOO donsites and temperatures
A STATISTICAL STUDY OF S ECOLOR ION TEMPERATURES AT
SIGN LATITUDES SASEO ON ATMOSPHERS EXPLORES C DATA
1.-5. Si.-Haustes (Center for Atmospheric and Space
Scionceas, Utah States Delversity, logan, Utah S4322]
We have seed 40660 simultaneous ion temperature and
drikt onsequentaries on Atmosphere Explores C to atudy
the ion energy balence in the high haritude 5 copion.
The large number of measurements allowed as to lind how
the mean lost resperature, and the average deviation
from that seen, change as a lunction of ion drilt speed
during solar minimum conditions. We tound that, in
splits of an apparent large scatter in the date, the
emasurements could always be reasonably supplained in
lette of iluctuations to the soutcal dynamical properties, so which the ion sourgy is coupled. The sesuits
also provide avidence for increased neutral drives as
the lost EXP drilt increases. Evidence for systematic
los drag states to a slos be found, on the average, tor
h.C. elactric tields stronger than 60 mV/s.

J. Geophys. See., Space, Paper JA1703

SSIO Toral Siectron Contact
ELECTRON CONTENT MEASUREMENTS WITH GRODETIC DOPPLER
ELECTRON CONTENT MEASUREMENTS WITH GRODETIC DOPPLER
a. Lairingor (AFGL/LIS, Air Force Geophysics Laborator2,
Ganacco AFR, Bedford, MA, 017311, G.K. Harmann, F.-J.
Lohanr, and E. torz.
Goosi stionary satellites with radio baccoing scarce. In
this situation it is important to plan for other posartbilities. Silterential Doppler data Iron the polar
orbiling Savy Mavigation Statilite System 1998ai have
been used successfully iron a natwork of teceiving atations in turope. It would be worthwile to use Oilletontial Boppler on a larger basis. Modern reteiving equipment low gadetic parposes based on NNSS signals should
be considered as as important source of data for lonosphark: research. We try to demonstrate the importance
and usefulness of this source atreasing spacifically
investigations of the asjor geomegnatic store which has
its sudden consencement on April II, 1561, During this
swent we could gain data tres lour saddictons! "geodetic"
stations which improved considerably the resolution
in longitudes. Unseed longitudinal dilterences in accora
response of the lonouphwric olactron content were
defeaced. This ellect would have remained unneticed
without the addictional receiving stations. JESuctton
content, geodatic Doppler receivers, magnetic etorn
response of lonaphure.)

5580 [Nave Propagation]

57871RTICAL CHARACTERIZATIONS OF EQUATORISE

671871RTICAL CHARACTERIZATIONS OF EQUATORISE

671871RTICAL CHARACTERIZATIONS OF EQUATORISE

671871RTICAL CHARACTERIZATIONS OF EQUATORISE

Manyland, 108711, C. H. Liu

The norphological sapect of glapheriz squatorial

accardilations in the Asian Hegion has been reported. As a foliow-up, this paper studies the
elactricical aspect of equatorial solutilizations in
the same region. Power apacitics of prominent scintifiation events collected over a 18-month period
during the rolar salmus [1618] in sunsystemy of the
version of the salmus [1618] in sunsystemy of the
high-trequancy and was analyzed with respect to the
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regularities. Autocorrelation calculation provided a charactaristic comment interval, 7. The study suggests that equatorial ionoapheric irregularities in the F-region, with subblicator state in the evening hours siter local suggest are the main cause of the glosharts stitulisations observed. The spectra of the irregularities appear to be the power-law type, with spectral indices, p, that generally have welves greeter than 4. The charactarisations of C4, 4, and 7 for both the Fertilic and indian Ocean Region inthis provides an important hasis for improved societing of ionoapheric scintiliation phenomena in the Anian Region, 161-jaherts fluctuation, equatorial scintiliation, Ped, &ci., Papar 351734

AN ATTEMPT TO REASURE THE FIELD-ALIGNED GRITT VELOCITY OF THERMAL ELECTRONS IN THE AURORAL LONDSPHERE

(. R. O. SLOTEY (STAR laboratory, Stenlard Electronical Laboratoriae, Stanford, Celifornia 94305), and J. Thield A. medium-fraquency (0.1 - 1.5 MHz) mutual-impedence proba was flown on three rociets (in the muroral lanosphere, los the purpose of measuring the field-aligned drift velocity of the thormal electrone. Belaited results are prosented from one of these expariments, in which a sensitivity of the order of the celetron thermal velocity was achieved. Downward alectron drifts were indicated, but their high apparent velocities cast doubt on their mathematicity. Determonthis and (he other two expariments suggest that the problem needs to be solved, and the sensitivity improved by an order of magnitude, in order for the probe to become a useful measuring inscrement. (Mutual-impodence probes, lower oblique resonance, field-digned carronts)

3590 Techniques
NITHRAB: A SPISF DESCRIPTION

G. de la Beaujardibre i Eddio Physics Laboratory, SHI
International, Memio Parh, California 94025t, J. Holt.

B. N. Wand, W. L. Silver, P. Beur, M. Slant, C. Smntor,

G. Alcaydé, G. Caudai, J. Fosior, E. Nielson, and H.
Realis

Baywean May 1981 and Juno 1982, an intensive campaign
of thiriy-three coordinated observations was corried out
using the three incoherant-actuer radors capable of
probing he surotal zons. Puring this period the aroups
operating the Gynamic Syriors mattalities and the STARE
radar made special eftorts to acquire data coincident
with the rader observations. The objective of these
RITHRAS experients and subsequent smallers is to
further our understanding of the interactions of the
sugnaturesphere, the iomosphere, and the thormosphere,
with special suphesis on local time/universal time
variations. Three experiments module with dilletent
time resolution and spatial coverage, was used to
sample dilletent sepacts of those interactions. The
samples of the evinestve data see involves collaborasilon among groups of experimentars as soil as latwon
superimenters and thootalicians. Cluscheront cealing.
high latitude, plasma convection, longitudinel effects, t
End. Sci., Papar 381740 End. Sci., Poper 351740

1599 Camarai (Thermai Electron Honting)
THERMAL RIECTRON HEATIMA BATE, A DERIVATION
V. O. Hongy (Code 9bi, GSPC, Graunhait, MO 2077ii
A formula for the thormal electron heating take In
derived from the hinstit equation using the electronelectron co((ision operator as given by the unified
theory of Xihata and Aono. The derived heating cate Q
is the aum of three terms, Q = Q + E + V Qint; which ator
taspectively: |) Privary electron production term hveling trom newly camera electrons that have out
self-are deciliations; |2 marry surface tarm - emergy
transler between Maxwellian and tail electrons at the
transition surray. Sq. of these two populations; and
integral term - hveling of Maxwellian electrons by
tell electrons at easigles > Er. The new hveling rate
case differ significantly Yrom electron heating rates
used in the pablished literature. Mumorical escaphes
are given. (Slectron Heating Este, Slectron Energy
Eslence, Photoslectron Fluxi.

J. Geophys. Res., Space, Paper JAI701 J. Geophys. Res., Space, Paper 3A1701

Particles and Fields-Magnetosphere

5736 Magnetle Tail 5736 Magnetic tail
OBBERVATIONS OF MULTIPLE ICH SEAMS to THE MACRETOTALL:
EVIDENCE FOR A DOUBLE H- POPULATION
A. Candidi (Isritulo Finice Openio Interp(metarlo,
CRR, C.P. 27, 00044 Francati, [Openi Italini, and 8.

One hour of 1988 2 plasma experiment data shows the One hour of 1988 2 plasse experiment data shows the coexistence of ignospheric oxygen look and protots with solar sind alphas and protons in the geomagnatic tail low latitude boundary layer. The two proton populations have different angular distributions. This is amplained simply, on the besis of the sammaption that the two populations were injected on aggretospheric field lines at different allitudes.::Ion besse, conjected distributions). cal distributions). J. Geophys. Res., Space, Paper 3A1465

5736 Hagnetic Teil
THE STRUCTURE OF THE PLASEA SHEET-LORE
BOUNDARY IN THE SEARTH'S MACHESCHAIL
G. Oreini (ISSI/ORE, O.P. 27, COO44 Francati,
Rome, Italy), U. Gandidi, V. Formisano, H.
Balsiger, A. Chielmetti, R. W. Odibid. Rons, Italy), H. Gandidi, V. Formismo, H. Salsiger, A. Chielmotti, K. W. Oglivis
The structure of the magnitotall glasma sheet-plasma lobe boundary is studied by observing the properties of tailward floring to ion streams. These have been detected thy the IRES-2 plasma experiment and the Explication opposition experiment inside the bouldary during three time periods in April 1978 likts

from the ISEE-i electron spectrometer ere and to define the locaties of the boundary.
The donnily of the O ion stresse has a relative maximum and their flow velocity and

a relative minimum at the boundary.
The XY drift velocity OSE component agrees the leoal magnetie field changes its sign of the boundary, indicating a reversal of the E olsotric field compensat. These changes us concisiest will the lopology of the electric field in the tall on napped from the ime-

1. Grophys. Fra., Spare, Paper Bal448

J. Foynman (Department of Physics, Boston College, Chesting Hill, MA. 021072, O. A. Herdy and E. G. Halles Air Force Goophysics Laboratory, Ratagon att, Bellett.

HA (1731)
The position and etunt of the region to which color true with energies less than 40 ha are during trapped in the nightenide augments phare in load for both covering the seven and the seven are the seven and the seven composits courdinates is introduced. It there are of the fact that this tegion of the magnetaphers is strongly in ligarical by both the Earth's first light as roughy an inveced by both the Earth's dirt thes and the direction of the solar wind. In equilic continuous pass, a tell wheten them are elected than an electronical plane and 1.2 be in bell width. At large requested with plane and 1.2 be in bell width. At large requested contribute latitudes there is excess region for in an i.8 thick within which 40 by electron i laws rank in trapping flowedly exclude over some them and in the plane of the plane. the satellite. We have no ordered that SCATH ever unfored the Lail index where no particles are expec-tions Koch - the togism in which 4s ket sistem them were always present moved earliered sedfor thread of tomained undered in compactic coordinates. We segre-that the new coordinate system will be careful for ordering other data sols taken in this tegion of the wagnet opphure. I dropoul a, by a section trapping, injustions, kinging regions.

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1/45 Magnet-ophusic conliguration
NING CHIPLIAN MUPPLE HPLICATIONS FOR THE CROSS STATE

1/15 Magnetrophusic configuration

Nink inductions

Nink inductions

N. U. Trouber (importment of Almospharic Sciences, CLL),

Lun Ampteus, Callitation 90010), G. L. Sieres, E. A.

Mayle and M. I. Sarke

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J. Geophys. Res., Space, Paper 341662

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8766 Planus ion Cability

COM-BERN-DRIVEN ELECTROSPATIC HYPROBEN CYCLOTRON MODIFICATION

N. CRUCIA MINICIPAL TRIES, LITTER

N. CRUCIA and K.-I. Highlaws (Planus Syrication and Laboratory, Bringston Enlystrative Princeton and Marsey 08388;

The shown analytically and by assume of Minicipal Commenced. Simulations that the large emplications that the large implications and account by inversely licely in heavy eather theo by field-aligned corresponding to the best conditions, alactric field and account in the conditions observed in the frame of preferrods loss and long observed in the frame of preferrods loss and these the cold of the best conditions and mastrical plumiquical singers in soch the them?

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Instability to should be in beauty in the condition of the condi J. Comphys. Ros., Space, Paper 3A1568

THE PLANT FOR (RYCROGERI CYCLOTRON AND ION ACQUISTIC MICROSTATE FOR REGIONS OF DEPART FILLIA-ALLONED ON BEAST LINES IN REGIONS OF DEPART FILLIA-ALLONED ON BEAST LINES AS STATES, CA. 947201 Miliotale, Serbalez, Ca. 947201 Miliotale, Ca. 947201 Miliotale, Serbalez, Ca. 947201 Miliotale, Ca. 9472

a T_1 T_1 it to lound that the ion beam acts as free energy courts only in regime 1. This regime is free energy courts only in regime 1. This regime is five infirity unatable to the electrons as a free energy sorce. Unstable modes to tengines J and 3 seem to be seen to be sufficient to the second of the energy features. In this case, the ricetrons are the iran courty feature, the tengine desping.

Licetin, 1860, 59aCo, Paper 2A1692

971 (Trapped particles) ME MALEL DISTRIBUTION OF BADIATION HELT PROTONS E Jestich, tost (tox 16r telno und Angewandro Kotophysik in Chieflen-Albrecht-Universität Kiel, 2300 Kiel,

to pretest quest-analytic solutions to the proton situden equation, with energy degradation and charge many large included. The transport ands (a modeled as a fig. g(f,t), where M, P and L are the adiabatic implicate, and & refere to the apactral index of the Secordar electric lield. At the outer boundary, say 1 . 7. I distribution function of the lore t = esp - $[(X,U)]^{\gamma}$ is rejectived at the inner boundary (L \sim 1), its regulard to vanish. We flad that Girle Alferico flux la directed outwards, when assret

lets and charge exchange are to approximate beliency Dib shope of the proton flux is ettengly affected by the spectral ladex of the ffuctueting tholds i) the protes flux exhibits both posicive and segacive

pullents with respect to energy all the anisotropy of the proton thux increases with decreasing L-value, and map pare through a minimum with respect to savergy.

L Contre. See., Spece, Paper 3A17GB

The very propagation to grassing for the compagation to grassing for the form PRILSATIONS

L. Les [Goophysical tentitues, Bedwarmitt of Midts, Feithelas, Alanha, 99701, and T.C. Funk.

The 1797 polsetions are assumed to be generated in the region where the low-density content in 180-100 her? Dejected during substores ancounter its Migh-desiry planua sphera. The increase in the uni involved during the 1809 avance to propagat to be exacted by the enhanced dispersion of the wave relative for to the presence of the helium lone to the planua form. In the presence of the helium lett, the writtion in the traveling time of the matth's writtion in the traveling time of the matth's writer to in the presence of the helium lett, the writerion in the traveling time of the matth's writer in 18 found to be typically \$ - 20 win, with in temperable to the duration of tens of the chitted (FP wents. (Fulsations, instability, painters).

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5799 General ISbutile Olovi ON THE ShUTTLE GLOW ITTLE PLASMA ALTERNATIVE

A KOLE ON THE SATE SENSITIVITY OF SAICTIONAL SLIDING OF MESTRALY ANALY.

P. Solbarg and J. O. Syrrles (U.S. Caclogical Survey, 345 Niddlefield Road, NS/77, Mealo Sark, CA 94015)

The irictional aliding of similared isotic containing crusted Westerfy grantle was sucided in a series of constant arapped velocity experience. Conlining pressures were varied from 100 MPs and aliding velocity varied from .00733 to 1.33 bm/s. The atrainate series were varied that is, the slope of the irictional stress change (a) with the logarithm of the cisrage in velocity (logyoy/Vy) was bound to be lon and pressure dependent, increasing with increased coulding pressure to a maximum of approximately .01 at 300 MPs contining pressure.

J. Coophys. Ros., Eacth, Espoy 381631 J. Ccophyn. Ros., Satth, Sapar 381631

6193 Genera) (Acouslit Anisolropy)
CALCITE FABRIC AND ACQUSTIE ANISOTROPY IN DEEP-SEA
CARSCHADES
C.K. Schallenear (Depl. of Geophysics, Taegs
ASM University, College Station, Tt. 77943) and
D. College

ASM University, Collega Station, Tt 77043) and R.I. Cacisen

R.I. Cacisen

Several invectigators have proposed that

compactational-wave entactropy in indurated,
deep-sea carbonatus is tauted by a preferred
attentation of catcite c-asea normal to badding.

Ta teel this hypothesis, we have used 1-tay pole
figure gomiometry to measure calcils Eabrica in
three entsotopic, calcateous sadiment emples from
500 Wole 516f, on the Rio Grande Risa. Antactropy
in these samples ranges from 3.4 to 12.0 percent.
The suggested contentication of c-ases is present,
but very weeks contentrations of c-ases is present to
budding are in the tange 1.1 to 1.3 percent fer in
percent area. We used the Vegi-Russe-Mil awarding
achama to telcuicite vehecities inon the 2-ray
fabric date, and leund that seem is nonporout, pure
carbonate rocks, heving the observed contentrations
of c_cases, the acoustic ententropy would be less
than I percent. We conclude that prelatered ententration of calcite is not a significant contributor
to compressional-wave ententropy in deep-see
sediments.

J. Geophya. Res., Surth, Paper 381695

Planetology

6360 Meleoristic COMPABISON OF YAMATO AND VICTOPIA LAND POLY-MICZ EUCRITES: A VIEW FROM MINEPALOGICAL AND ISOTOPIC STUDIES H. Takeda IMineralogical Institute of Science, Hongo, Tohyo 113, Japani, J. L. Wooden, H. Moil, J. S. Delaney, M. Prinz, L. E. Nyquist

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Thomas C. Grenfell

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Atamation of Capillary and Dravity Waves at Sea by Monomolecular Drganic Surface Films (Faper Molecular Drganic Surface Films (Faper Molecular Stolie Hichrich Hahmerfase, Werner Alpers, William D. Garrett, Philipp A. Lange, and Steeffied Stolie Rebotch Hahmerfase, Werner Alpers, William D. Garrett, William C. Kellet, Philipp A. Lange, William D. Garrett, William D. Garrett, William D. Garrett, Philipp A. Lange, William D. Garrett, William D. Heatment of Breaking Waves by a Surface Jump Meier (Paper 3C481)

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Set Surface Temperature Patterns and Alt. Sea Fluxes in the Corners Bight During MARSEN 1979, Phase 1 [Paper 3C111])

Kristina B. Katsdros, Armando Fiaza, Falinio Sousa, and Volker Amann

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6560 Hatmoritica GROUDRICES AND OTHER COMPONENTS IS C. O AND E CRONDRITES - RIMILABITIES IN THEIS PROPERTIES AND

CHORDRILLE AND OTHER CONCINENTS IS C. O AND C CHORDRILLE AND OTHER CONCINENTS IS FROMERIES AND URIOUS Edward S.O. Scott (Institute of Meteoritics, University of New Marico, Albuquarque, EM Silžij and O. Jattray Tajlor

Ve describe three types of chordrules that are common to 0, 11, 3, CM., CO2 and CV3 chondrites. Low-and high-FeO, perphytitic cliving chandrules contain cliving with SaO., -E and Fais-50 respectively, and can easily be distinguished getrographically. Polksilic pyromene chandrules have 1-20 vol. X oliving FaO.-2-01 enclosed by iow-Ce pyromene (Fa6.5-1), and also occut in Schodrites. These three types formed in separate mabular regions which bad divensions and apacings such that a taw percent of the chondrules and apacings such that a taw percent of the chondrule at large present in the country of different types, borting of chondrule precurent material and mixing of chondrule types probably account for most variations in bulk and others chosen country of the condrules from elitype t and least assamptionsed type 3 chondrites. Healing compositions reflect reduction during chondrule types probably have related or condensation. Opeque materices in type 3 ordinary and exthensions chandrites are measured in all howe chondrite gramps abore strillar mebular origins. Vecunités the the chondreles in all howe chondrite gramps abore strillar mebular origins.

6360 Metaorilica
BRACHINA: A NEW TYPE OF METEORITE, NOT A CHASSIGNITE
C. E. Nebru iDepartment of Minetal Sciences, American
Museum of Natural History, New York, NY 16620, M.
Prinz, J. S. Delaner, G. Dreibas, H. Palme, B. Spettel and
H. Wanke

Museum of Natural History, New York, NY 186283, M. Prinz, 3. S. Delaner, G. Dreibas, H. Palms, B. Speitel and H. Wanke

The Brachina mateories, previously classified as a changinite, is found to be a nearly primitive and unique mateories. It is a line-grained, unshocked equigranular igneous rock containing small mail inclusions. If contains 20% oilvins 1F076, 5.3% clinopyrousne 1800gEnapFs. 10% plegioclase (Anggl. 6.3% pentiandite, and a trace of Ni-rich metally critopyrousne 1807gb and anot thoclase-rich glass are found only in meit inclusions. Siderophiles are high in the suillides, and the unidation state is similar to that of L1-chondities. Major element and mineralogic dots of Diachina are cimilar to Chassigny, but trace element data are demantically different. The major differences are higher Pec/MnO, Ga/Al, and M.La ratios. W depletion, high siderophile content, near-horizontal PEE pattern at about 1 x chonditie level, high refractory/nonciractory metal ratios is.g., Ir/Aul, and chalcophile element depletion. Compositionally, Brachina is close to C2 chemiatry, but has undergone some sagregation of 1Fe,Nills mait. These data, in addition to its near 4, b.y. age, sad oxygen isotopic elegature within the currict field, suggest that Brachina is not related to Chassigny or SNC meteorites. It may be related to primitive meteorites, but is more oxidizad; tenderited with the relation would make it very climital to winonates. The superhinger may have experienced the Aginning of melting in its parent body. Since it has chasecteristics that different mind of the part of the content of the superhines. The conhiles, Inchendites, trace elements, brachinisch.

J. Geophys. Yes., Earth, Faper 38504.2

9547 Surtace of Planets

1GE AND ORBEIS IN THE PRITTED TERALN, MARE

8. E. Lucchitte, (G.S. Geological Survey, 2235 Booth

9533 Gealai Driva, Plagmani, Arisma, 86001

Vibiag moderate—and high-resolution images along che

outhern highlend wergin were studied monoscopically

and stereoscopically to coctribate to as understanding

of the development of tretted terrain. Emults support

the hypothesis that the Iretting prosess towelved then

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debris aprons is most ithely desired treated in

the pest as well as the present, interatifial tes in

debris aprons is most ithely desired tree ground is

obtained by sapping or mosty collapse. Debris aprone

onaleted mostly of debris. To remove the debris, wind

sroulon was alther very istems sarily in martian

filter, or was istermittent, perhape owing to climate

species. The location of debris appears to two mis
intiminal hatce eto be attributed to atmospheric

oodditions that perelt for to remain in the greand at

moderate dapth in those latitudes, and climatic factors

that perelt temperatures to have amongh tot fee to

yellow. Fratted channels have mislams gradicate of 3-8

a/he, which persite flowing ica to defore by

dislocation areas at accondingly for acrein tstes;

shelps. Sy sealogy with the frestend channels, ica

could have llowed through the outflow channels, ica

and paralted iss to sriet in the equacatici area.

(Bock electors, timatic cycles, greend-ion stability,

channels.)

J. Deophpa. Ess., Earth, Paper 285120

J. Deophpa. Esa., Zarth, Paper 285120

6380 Tekticas HICROHEGHIZITES SECOVERED FROM A SEDIMENT SAMPLE PROM THE ZHANGESHIN INPACT ETRUCTURE S. P. Olass (Geology Department, University of Delaware, Hawara, Palaware, 19161, K. Fredriheson, and

Thomas C. Grenfell

Thomas

Seismology

6970 Structute of the crust and upper species
SEINKIGITY: PANE MAKE SOLOTIONS, ESTIN OF
PANETERS, AND ACTIVE RECTORICS OF THE ADDRESS OF
PROS. SCHAPOR, AND SOUTHERS COLOMBIA
Octavic Saures (Capariveot of Earth, Atmospheric,
and Planetery Science, Heasechasette Inscitule
of, Tacksology; Cambridge, Mr. ACIJS); Pater
Molvet, and E. Clark Eurobfiel
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of Forty, Soundor, and speciality of the Ander
of Forty, Soundor, and speciality of the Ander
Compositivity along the easterment Flank of the
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sub-Andes. The local depths and lasit plane solutions of the largest seenth were constrained by coopering the observed long-poried F waves with synthetic wavelers. In general, the last place solutions show reverse lastisting on sleeply dipping nodal planes striking northwest-southeast and reliect crustel shortoning perpendicular to the reago, probabity in response to the nubduction of the Basca plate to the vest. Earthquests to the read-Andes occur at depths of between 8 and 28 km, indicating that each of the crust deforms in a brittle namer. The solumities weeks to reliect antithotir underthrusting at the Statilian shield beneath the evestern surgin of the Andes. However, the earthquebes are too deep and their nodal planes are too steep to be associated with the thin-stimed decaliment of the soluminary cover. Instead, they appear to reflect the textonic deformation of the unterthrust becomen west of the same of active deformation at the surface in the sub-endes. Hence the carthquebes on the oast side of the Andes.

Solar Physics, Astrophysics, and Astronomy

7743 [Particle radiation]
COMPARISON OF THE SOLAN COMMIC PAY EVENTS ON MAY 7,
1978 AND ENTHRORS 22, 1977
N. Debrunner ishyalksischem institut, Gniversity of
Garn, 1872 Bern, Deitzertandi, E. Flüchtger, J. A.
Lookwood, and R. E. McGutrs

As anatysis has been made of the solar consideray
events on 7 May 1878 and 12 Hovember 1977 to detersince the energy spectra of the solar proton from 88
May to 10 GeV, the place angle distribution, the
intensity-time profiles and the antactropy-time
profiles. Date two neutron monitors and 1897 and 8
setallites were wend, it is bound that the energy
proton of the solar protons obtained from toutron
monitors and satellite observations are to good agreecent in the overiapping energy range when the pitch
angle distribution is caken into account. The energy
spectra covaring throw decades of energy and sight
decades of intensity and below the wartetions were
remarkably similar for the two events. The divisorous
in the neutron wonitor responses for the avents was
mintp due to the different pitch angle distributions.
For the prospi particle event on 7 May 1978 the shapes
of the iotensity-cime profiles for varioon energies are
the result of the energy dependence of the timestands of hatcoling frotten into the interplanetary
medium. This event is empetable importance for the
study of the accessor of enlar particles and thair
subsequent injection into the interplanetary medium.
For the 21 Movember 8977 avent, were though the
propagation of the tolar protoco in the 1M7 was assentially difference of the solar particles and their
subsequent injection into the interplanetary medium.
For the 21 Movember 8977 avent, were though the
propagation of the tolar protoco in the 1M7 was assentially difference particles and energy dependence.
[Osseierap events, place angle, totanstry-time
prolified.]

J. Geophya, Res., Space, Fapar 3A1750

J. Geophya, Ros., Space, Paper 3A1750

General or Miscellaneous

9520 New Fields
A SIMMY STATE by ALGORITHM FOR OPERATION PROBLEMS OF
MULTIMESHAVOLE SYSTEMS
MILE Orders Department of Indusarial Singlinering and
Operations Essential, Systems University, Systems,
Eve Tork, 13210)
Reservoir opatation problems are complianted by the
non-linearities to the objective functions. The dynance programing promodute he often used to tolve this
probles becomes of she aspealed in meure of the dectsions involved. But, for simultaneous operations of
nulti-remervoir systems, other DF-based techniques are
frequently found to he more elficiant to overcome the
cursar-of-dissiplication to the DF-based techniques are
frequentles of the dealshoos. Le This paper, another
DF-based prosedure is proposed which parforms hatter
than the other well-known tachniques. The significations
of the technique are presented to top difference formulacious for four-reservoir speciation problems. The
aconvergence properties of the elgosithm are investiment of the problem with vertices disappiams. (Mailsfteasrool's operations, dynamic grogramsing,
dismujonality, delerminished.)

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